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KEEPING ON THE RIGHT PATH

A WEEK rarely goes by without some event which draws attention to one or other of the many facets of the aeronautical research and development scene; and almost inevitably it points to the truth of the old saying that the more one knows the more one realizes how little is really known. Solving problems always poses more problems and, when one set of answers is obtained, the way is often pointed to farther-reaching questions which, too, are in need of answers. In these respects, the past fortnight has seen a rather larger ration of research and development references than usual; indeed in this issue we include three accounts of matters of this sort.

For example, in Paris last week on the occasion of the annual Blériot Memorial Lecture, as duly recorded on another page, Prof. W. J. Duncan, an eminent aeronautical engineer, chose to review the whole field of aeronautical research. This was indeed a timely subject for such an international occasion and although such a dissertation could not be expected to produce any startling conclusions or suggestions it could—and did—serve as a most helpful and comprehensive summing up of the research situation.

Speaking of military aviation and the current change in emphasis from manned aircraft to unmanned missiles, the lecturer expressed the view that there would be a demand for aeroplanes and helicopters for very many years. So far as the civil aircraft business is concerned he concluded that the total demand for aircraft would expand for many decades to come and opined that those nations which have a lead in the civil aircraft industry will "unquestionably reap a great reward." He did not agree that astronautics would be established as a practical reality within a few decades; but he thought it possible that the Moon might be reconnoitred by a missile-cum-satellite "fairly soon."

All of this serves to point to the need for a lot of hard and extensive work on the part of those engaged in research of various kinds—whether it be directed towards supersonic civil airliners or satellites. The learned lecturer made the point, incidentally, that the fundamental research problems of missiles and satellite vehicles have much in common with those related to the more orthodox forms of aircraft. However, it might be added that when it comes to the equally important aspects of research and development that are represented by full-scale trials, then the guided missiles and satellite fraternity need separate test facilities of a magnitude that surpasses anything that their more down-to-earth colleagues require.

This brings to mind the size and scope of Australia's Weapons Research Establishment at Woomera; and here it is fitting to draw attention to another recent lecture recorded in our pages this week. We refer to that given before the new Guided Flight Section of the Royal Aeronautical Society, in which the deputy controller responsible for trials and instrumentation at Woomera described in some detail the work of that notable establishment. Quite apart from its activities as a testing ground for our guided missiles and research rockets, the W.R.E. devotes a good deal of attention to the development of test equipment and techniques—which is another important part of the overall research pattern.

To return, however, to Prof. Duncan's thesis at Paris, it was interesting to see that among the subjects he considered as an important matter for research was that of the dissemination of knowledge. Indeed he went so far as to say that this was "imperatively demanded." Certainly the growing complexity and scope of the science of aeronautics have brought in their wake a deluge of paper in the form of textbooks, official reports, lectures and learned articles from all corners of the World. As Prof. Duncan suggested, this stream of knowledge must be brought under control and channelled if it is not to defeat its own object and slow down rather than accelerate absorption of knowledge.

The lecturer's remarks about duplication of aeronautical research effort will, too, we hope, be carefully considered. Pleading for "real efficiency rather than narrow financial economy" he pointed to strict application of the rule of "no duplication of effort" as one way to apparent economy. But he went on to propound that complete avoidance of duplication was not necessarily a desirable aim and that real progress is sometimes best attained by several simultaneous and independent attacks on the same problem.

However, be that as it may, no matter what aspect of research and development is considered, the inescapable conclusion to be drawn is that sustained effort as well as continuity of programme are of paramount importance. As we have said before on this page, this is a job for an Air Planning Authority charged with the task of co-ordinating the next decade of research. And not only must any such planning be responsible for determining the broad paths along which our research workers should tread, it should also direct their work in such a way as to allow for the minimum "desirable" duplication of effort to get the real efficiency that was discussed at Paris.

MATTERS OF MOMENT

An Anglo-French Occasion

A LARGE and international audience of eminent aeronautical engineers and scientists gathered at the Aéro-Club de France in Paris on March 5 to hear the eleventh Louis Blériot lecture. British representatives included Mr. E. T. Jones, a past-president of the Royal Aeronautical Society; Dr. A. M. Ballantyne, the Society's secretary; Sir Frederick Handley Page; Mr. Stewart Scott-Hall and Mr. Handel Davies. The Society of British Aircraft Constructors was represented by its president, Mr. C. F. Uwins, and its director, Mr. E. C. Bowyer. And also among those present was that remarkable man of aeronautics, Dr. Theodore van Kármán, chairman of AGARD.

Organized jointly by the Royal Aeronautical Society and the Association Française des Ingenieurs et Techniciens de l'Aéronautique, the Blériot memorial lecture is given alternately in London and Paris. The speaker this year was Professor W. J. Duncan of Glasgow University who had chosen for his timely subject "The Future of Aeronautical Research." Some of the many noteworthy points he made in his lecture appear on page 364.

The distinguished lecturer—who was introduced by the president of A.F.I.T.A., M. J. Jarry—made a short speech in French as a prelude to his paper. Professor Duncan's text was then read, in French, by M. S. Melville of Sud-Aviation.

After the reading of the lecture a vote of thanks to Professor Duncan was moved by M. Maurice Roy, director-general of O.N.E.R.A., the national aeronautical research institute of France. M. Roy said how right Professor Duncan was to stress both the importance of research and the need for economy in its execution; and he remarked in jest that the cry for economy was in keeping with the lecturer's nationality.

Following the usual custom on these occasions, after the lecture there was a cocktail party and a banquet, at which Mme. Blériot was a guest of honour. Speeches were made by M. Jarry, by Mr. E. T. Jones and by M. Louis Christiaens, the French Air Minister.

United Kingdom Defence

PRESENTING the Air Estimates to the House of Commons last Monday, March 10, the Rt. Hon. George Ward, Secretary of State for Air, outlined details of the net saving of £20 million in this year's total expenditure of approximately £467 million, as compared with the 1957-58 figure. This is being made by spending less on aircraft, maintenance and building works, and Service and civilian staffs; though more is to be spent on armaments, including missiles and weapons of all kinds.

Turning to the operational side of the R.A.F., the Secretary of State made it clear that we are developing a long-range version of the stand-off bomb. He also said that having examined most critically the length and time which the V-bomber force is likely to remain an effective deterrent, bearing in mind the increasing power of the enemy defensive system, he was quite certain that we can rely on this force to remain highly effective, certainly until it is supplemented by the British intermediate-range ballistic missile. Even then the V-bomber will still hold an important position.

Later marks of the V-bombers (Victor 2 and Vulcan 2) will have considerable advantages over the earlier versions because of their greater range and the powered bomb which will give them a wide choice of approaches to a given target. Furthermore, their increased operating heights will make them less vulnerable to enemy defences.

Regarding our own defence, we are improving the performance of our fighters and their weapons systems, besides introducing the Bloodhound surface-to-air missile. This year will see the introduction of the Javelin F.A.W. 7 and the Firestreak missile which goes with it. Later on, the Javelin Mks. 7 and 8 will be given re-heat to extend their effective lives, and the P.1 will come into Fighter Command. The performance of this aircraft will be improved by having electronic computing equipment to tell the automatic pilot where to intercept the bomber.

Service trials of the Bloodhound system are to begin at North Coates within the next few weeks, and from these trials the Service doctrine for the handling and maintenance of the missiles, and its co-ordination with the manned fighter defence system, will be drawn up.

Summing up, Mr. Ward said that we are not only steadily improving the quality of the nuclear deterrent and its defence in order to prevent a global war, but we are also improving the quality of that equally important part of the R.A.F. whose duty it is to deal with localized outbreaks of trouble which might develop in the Middle and Far East.

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MOSCOW AGREEMENT.—Air Chief Marshal Paval F. Zhigarev, chief of Aeroflot, and Lord Douglas of Kirtleside, chairman of B.E.A., sign the inter-line operating agreement in Moscow on February 26. News of the agreement and some background information about it appeared in last week's issue (page 312).

Sapphires for Switzerland

AFTER more than 18 months of close collaboration with the Swiss Government, Armstrong Siddeley Motors, Ltd., has received confirmation that the Sapphire turbojet is to be built under licence in Switzerland. The order is worth £2,800,000.

The agreement follows a request by the Swiss Government for credit with which to build a hundred P.16 supersonic ground-attack fighters to be powered with British turbojets. On March 7 the National Council, or Lower House, voted against buying the engines from Britain in favour of making them in Switzerland.

The first prototype P.16, and the second prototype and 36 production aircraft (redesignated the P.1604) are powered by the Sapphire. The aircraft are built by the Flug and Fahrzeugwerke, A.G., of Altenrhein bei Rorschach.

The Chamber also voted to increase the credit asked for by the Government from 407 million to 441 million francs (£33 million to £36 million). The matter was due to go before the Council of State (or Upper House) this week.

Latest Lightplane

WORKMASTER is the name of a new Auster aeroplane designed for general agricultural use. Fourteen are on order—nine for Crop Culture, Ltd., and five for an associated concern, the Ardic company of France.

Following the well-established line of Auster high-wing designs, the Workmaster has a 180-b.h.p. Lycoming O-360-A engine driving a McCauley Met-L-Matic propeller. Britten-Norman spraygear is fitted and 90 gal. of spraying fluid can be carried in a tank beside the pilot. In an emergency all fluid can be dumped within 5 sec.

The Workmaster seats two in tandem, has a gross weight of 2,550 lb., a span of 36 ft., an economical cruising speed of 88 m.p.h. and the take-off run is 180 yd. Large main wheels are fitted, as used on the Auster A.O.P.9, for ease of operation from unprepared ground.

Coming directly after the more specialized low-wing Agricola, the Workmaster looks to be a somewhat reactionary design but, in fact, there is a need for both types of aeroplane. The new type is essentially a cheap and simple aircraft which should find ready use for operators requiring a small aeroplane for "short-haul" crop treatment, the Agricola with its 144-gal. capacity being relatively a "long-haul" type.

Getting the Public View

INTERESTING indications of the general trend of public opinion regarding the affairs of the aircraft industry were gleaned in a Gallup Poll survey recently made for the Society of British Aircraft Constructors. Of those questioned, 84% felt that the aircraft industry was an important one for Britain. No less than 79% were in favour of the Government providing research facilities such as those at Farnborough for the use of the aircraft industry as a whole.

On the question "Should the Government help the British aircraft industry by placing orders for new aircraft?," the poll showed that 70% of the people questioned thought that this should be done; and 78% felt that the Government should ensure that suitable British aircraft were produced for B.E.A. and B.O.A.C. Asked whether they would prefer to travel in a British or an American aircraft, 48% preferred the British product, 7% the American and 45% had no preference. Only people with flying experience were asked this question.

Asked about missiles, 66% thought that Britain should have a guided-weapons industry and 57% felt that British long-range rockets should be built. In the view of 19%, production of these rockets should be left to the U.S.; 14% were opposed to them completely and 10% were "Don't Knows."

There was little agreement about the future of the aircraft industry. Concentration into large units was favoured by 36%; maintenance of the *status quo*, by 30%; nationalization, by 17%. And the remaining 17% had no views on the matter.

NEW AUSTER.—Latest from the Auster company is the Workmaster, an agricultural type powered by a 180-b.h.p. Lycoming engine. It is a tandem two-seater and carries a 90-gal. spray tank beside the pilot.

A Finnish Anniversary

LAST WEEK the Finnish Air Force, which came into being on March 6, 1918, during the War of Independence, when Count von Rosen flew a biplane from Sweden to Finland, celebrated its 40th anniversary.

This year will also be noteworthy in the force's history because it is due to receive the first of a number of Folland Gnat light fighters, powered by Bristol Orpheus turbojets. Twelve of these aircraft are on order from the British company, and they are to be ferried out. Finland has also acquired a licence to build the type at Tampere.

At present the Finnish Air Force has the D.H. Vampire as its first-line fighter. Under the terms of the Peace Treaty with Russia operations are limited.

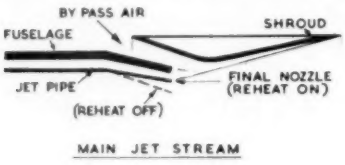
A FAIREY OCCASION.—H.R.H. The Duke of Edinburgh visited Fairey's aerodrome at White Waltham on March 3, where he saw the Rotodyne. He was escorted by Mr. G. W. Hall, the company's chairman and managing director. In this photograph the Duke is talking to Mr. Richard Fairey, the vice-chairman, other directors and the test pilots.

News of Aircraft, Engines and Missiles

ELAND OUTPUT. — The Napier Eland N.El.6 turboprop has passed the 150-hr. official type test at an output of 3,500 e.h.p.

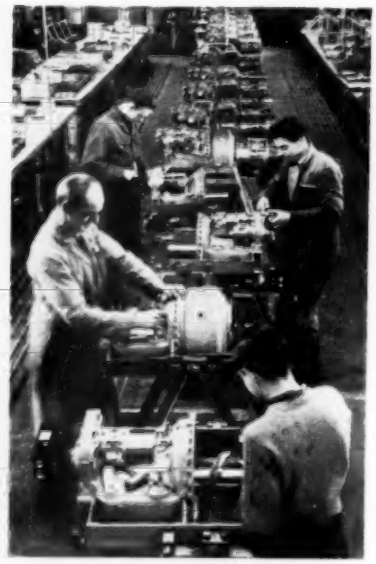
BRISTOL AT MILAN.—A Bristol Orpheus turbojet will be one of the main attractions on the Bristol Aeroplane Company's stand at the Milan International Samples Fair, which opens on April 12.

PRESTWICK EXPORTS. — As recorded in THE AEROPLANE for last week a Twin Pioneer will be delivered to the Red Lion and Sun Organization (Iranian equivalent of the British Red Cross Society) in the spring. It will be equipped to carry six stretcher cases and five passengers. Two Pioneers left Prestwick recently for delivery to the Iranian Ministry of Customs and Monopolies.



NEW NOZZLE.—An ejector exhaust nozzle is to be fitted to the Rolls-Royce Avon of the Fairey Delta 2. It will produce almost as much thrust as a mechanically variable convergent-divergent nozzle.

FOUR F-105s.—The Republic F-105 Thunderchief is on order in four variant forms: the F-105B day fighter-bomber, F-105D all-weather fighter-bomber, F-105E two-seat all-weather fighter-bomber and JF-105B test-vehicle.



POWER AT BROUGH.—The Blackburn (Turboméca) Palouste air compressor is seen here in production for the low-pressure powerplant starter developed by the company.

FLAT-RISER.—Ground testing of the Piasecki 59K VTOL aircraft, a mock-up of which is seen here, is complete. The aircraft has two ducted propellers and is intended for military contour-flying. It has two Lycoming engines.

NEW POLISH TRAINER.—The first flight of the P.Z.L. 102 Szczeniak (Puppy) light sports aeroplane is expected to take place shortly. This aircraft will be followed by the M-2, a two-seat low-wing monoplane generally resembling the Chipmunk, having a Czech 220-h.p. Praga Doris M.208.B engine. The M-2 is intended for the Polish flying clubs and will cruise at 149 m.p.h.

ROTARY DRONE.—Prototype testing of the Piasecki Sea Bat VTOL drone has begun. The Sea Bat is an unpiloted rotary-wing aircraft for use from ships and submarines, probably in an anti-submarine rôle. Lack of crew means that it may be expendable, being destroyed by the blast of its own weapon.

NATO NAVAL TRIALS. — Two French naval aircraft, the Breguet 1050 Alizé and the Air-Fouga C.M.170M Magister Marine, were to make deck-landing trials on H.M.S. "Eagle" off the French Riviera this week. Both aircraft have been to the Naval Air Division of the R.A.E. at Bedford for preliminary tests.

MIXED POWER.—A North American FJ-4F has been modified to take a Rocketdyne AR-1 rocket engine in addition to its Wright J65 turbojet.

707 TESTING.—In the first six weeks after its first flight on December 20, the Boeing 707 flew for 47 hr. 9 min. in 28 flights. A speed of over 580 m.p.h. has been reached, and an altitude of 39,000 ft. Tests so far have covered anti-icing, cross-wind landing and an ILS approach to Seattle-Tacoma International Airport, when the cloud base was at 300 ft. The 707 will now embark on the test schedule for C.A.A. certification.

PRODUCTION IN POLAND.—At the O.K.L. Aircraft Design Centre, Warsaw-Okecie, work is progressing on the MD-12 four-engined 20-passenger transport, the TS-11 Iskra (Spark) light jet trainer, the BZ-4 Zuk (Beetle) four-seat helicopter and the HT-1 Trzmiel (Bumblebee) light ramjet helicopter. A design team led by Dipl. Ing. S. Lassota is engaged on projects for an ultra-light aircraft for the flying clubs and on a twin-engined general-purpose six-seater for parachute training and agricultural work.

JETSTAR PLANS.—Tooling equipment used to build the two Orpheus-engined prototypes of the Lockheed Jetstar at Burbank is being transferred to Marietta, where the type will be produced if a military order is placed. A U.S.A.F. decision between the Jetstar and the McDonnell 119, which has not yet flown, is expected soon.

SUPER CRUSADER. — The Chance Vought F9U-1, developed from the F8U Crusader, is to be powered by a Rolls-Royce Conway by-pass or RB-133 turbojet. The span is 27 ft. 6½ in. and the length 54 ft. 6 in. The loaded weight is 21,825 lb. The Ferri-type air-intakes can be seen in this drawing.

Commercial Aviation Affairs

TRAFFIC INCREASES. — During 1957 there were 328,698 air transport movements at U.K. airports—an increase of 7% over the figure of 306,224 for 1956. The passenger total increased by 15½%, from 6,044,405 to 6,988,338, and freight handled (including vehicles) from 147,870 to 153,382 short tons, an increase of 4%. London Airport alone handled 3,513,443 passengers; the next highest figure was that for Manchester, Ringway, with 478,062—apart from the Channel Islands' aerodromes, where Jersey alone handled 559,090 passengers. The highest freight-handling figure was for Ferryfield, Lydd, with 52,063 short tons, and Southend's figure had moved up to 19,756 tons. Both these airports have vehicle ferry services; London Airport's freight total, without such an aid to high figures, was 50,033 short tons.

LANICA VISCOUNTS.—The Nicaraguan airline Lanica introduced Viscounts on the Nicaragua-Miami route on February 17, and will have two aircraft in regular service on its regional and domestic services soon. The first, with extra tankage, was flown out via the Azores, Newfoundland and the U.S.A., the other following the northerly route via Iceland, Greenland and Newfoundland.

CHEAPER ATLANTIC FREIGHT.—IATA carriers on the Atlantic routes are proposing to re-instate special rates for mixed consignments of freight weighing more than 100 kg. The new rate will be 40% lower than the normal general cargo rate for 45 kg. or less and will apply to consignments made up entirely of goods which are eligible for the various specific commodity rates.

GOOD SHOW BY SABENA.—On March 2, a Sabena DC-4 dropped spares to the M.V. "Polarhav," which was in distress 1,000 miles off the coast of Angola. The spares, which had been flown from Gothenburg to Brussels on February 28 and thence to Leopoldville on the regular Sabena service, were packed in cork in large drums and were dropped into the sea from about 50 ft. Doors were removed from the DC-4 for this sortie, which was completed within 72 hours of the first request from the shipowners. Brokers responsible were Air Services A/S in Oslo and Alfred Meerbergen in Antwerp.

ALITALIA BUY DC-8s. — Four Douglas DC-8s have been ordered by Alitalia-L.A.I. for its transatlantic services. They will replace the Alitalia DC-7Cs, used at present, in the summer of 1960. The original L.A.I. order for L-1649A Starliners was dropped when Alitalia and L.A.I. merged. The choice of engines for the Italian DC-8s has still to be announced.

CONSTELLATIONS FOR SALE.—William C. Wold Associates have been appointed exclusive sales agents by Lufthansa to handle the sale of two L-1049G Super Constellations. Immediate delivery is offered and "asking price" is $1,800,000. Lufthansa will retain six L-1049Gs, in addition to their four newly delivered Starliners.

NEW ECUADOR AIRLINES.—Cia Ecuatoriana de Aviacion began operations in November, 1957, using two Curtiss Commandos. It is now seeking permission to extend its services into Chile. VIOSA (Vias Internas Orientales, S.A.) is using three single-engined Cessnas for flights into territory east of the Andes.

ITALIAN HELICOPTER SERVICE.—A regular passenger helicopter service is scheduled to begin in Italy on April 10, linking Milan, Turin and Genoa. Later, international services to Lugano and Locarno in Switzerland may be started.

YUGOSLAV DC-6s. — J.A.T., the Yugoslav State airline, has bought two Douglas DC-6s.

T.W.A. PAY-LATER PLAN.—Instalment-plan flights are now offered by T.W.A. between Britain and the U.S.A. for as little as £16 down (10% total fare) and 21 months to pay.

INTERLINE AGREEMENTS.—United Air Lines has signed interline traffic agreements with five foreign air carriers. They are Alitalia-L.A.I., J.A.T., Olympic Airlines, Pacific Western Airlines and Empresa Guatemalteca de Aviacion.

PROBLEM FOR K.L.M.—Since the discontinuation of the services to Jakarta, Indonesia, K.L.M. are reported to have been negotiating for an increase in the frequency of their service to Sydney, which is at present flown once weekly.

AUSTRIAN STATISTICS. — There were 6,581 aircraft arrivals and 6,580 departures at Austrian airports during 1957, an increase of 24% over the 1956 total. Passenger arrivals and departures during November, 1957, numbered 6,170 and 6,808 respectively; Schwechat Airport, Vienna, accounted for most of the traffic.

NAVIGATORS CONFER. — The annual convention and conference of the International Airline Navigators Council will be held at the Piccadilly Hotel, New York, on April 22-24. Full details from the secretary-treasurer, Mr. S. Lasota, P.O. Box 162, Levittown, N.Y.

GREEK AIRPORTS.—The Greek Government has decided not to change the present location of Athens Airport. The possibility of using the military airfield of Tanagra after 1962 for aircraft which require a runway longer than 9,840 ft. is being considered.

THE WRONG RICHMOND.—An enthusiastic cartographer (issue of February 28, p. 283) took the Prime Minister's Britannia 102 from Darwin to Richmond, South Island, New Zealand, instead of Richmond, near Sydney, New South Wales. A haul of 3,400 miles or so would be a little beyond even the 102's capabilities.

MORE NEWS ITEMS ARE ON PAGE 367

News About People

APPOINTMENTS AT FILTON.—Mr. M. G. Wilde, Dip. Ae., Hull, B.Sc., A.F.R.Ae.S. (below, left), 33, who has been chief aerodynamicist of Bristol Aircraft, Ltd., since July, 1955, has been appointed assistant chief designer responsible for organizing preliminary design work on new projects. He joined Bristol

by Mr. H. A. Goldsmith (on the right), 34, who joined the aerodynamics department in 1947 as a technical assistant. He became an assistant chief aerodynamicist in 1952 and head of the preliminary design group in 1956. Both appointments became effective on March 3.

as a technical assistant in the aerodynamics department in 1944 and became an assistant chief aerodynamicist in 1952. He is succeeded as chief aerodynamicist

CONVAIR PRESIDENT.—Mr. J. V. Naish will become president of General Dynamics Corpn.'s Convair Division on April 1, when Gen. J. T. McNarney gives up that post. Mr. Naish has been executive vice-president of Convair and a senior vice-president of General Dynamics, and will continue on the board of the parent company.

AER LINGUS APPOINTMENT.—Mr. A. J. Walls has been appointed assistant sales manager for Aer Lingus. He first joined the company in 1947 as project engineer and after a short spell with one of the large oil companies he rejoined Aer Lingus in 1949 as development engineer.

NEW SWISSAIR CHAIRMAN.—Mr. Ernest Schmidheiny has been elected chairman of Swissair, in succession to the late Dr. R. V. Heberlein. He is a leading Swiss industrialist and chairman of the Swiss Holderbank-Wildegg Cement Company. He joined the board of Swissair in February, 1947, and has been a member of its executive committee since December, 1953.

TANGANYIKA APPOINTMENT.—Mr. Basil Sutton, D.F.C. and Bar, has been appointed regional representative of the Directorate of Civil Aviation in Tanganyika. He joined the Directorate in 1948 and after becoming a senior air traffic control officer in 1954, he has served as regional representative in Uganda. He succeeds Wg. Cdr. A. M. D. Howes, who retires after 10 years' service.

F-104 FATALITY. — Lt.-Col. Ray Evans, commander of the first Lockheed F-104 Starfighter squadron (No. 83) was killed during a GCA approach recently.

Kenya's New Airport Opened

Nairobi's new airport at Embakasi, which was opened last Sunday, is a physical demonstration of Kenya's belief in the future of long-haul air transport to and from the colony. Its 10,000-ft. runway and new terminal building should meet the needs of Kenya for many years to come.

NOWHERE can the news of the misfortune to the Qantas Super Constellation carrying the Queen Mother homewards from Australia and New Zealand have caused more disappointment than it did in Kenya. The resultant setback in the Royal arrangements caused complete disruption of the meticulously laid plans for the opening of Nairobi's new airport at Embakasi, 11 miles from the city.

Work has been going on at high pressure for months—ever since it became known that the operational opening of the new airport, planned for March, 1958, was to be preceded by a ceremonial opening by the Queen Mother. The original intention had been to postpone this ceremonial opening until September or October, 1958. Consequently only tremendous effort by the engineers and architects of Kenya's Ministry of Works could get the handsome, strongly coloured buildings and control tower ready in time for the great day.

As guest of the Kenya Government, the Editor of THE AEROPLANE was able to inspect the airfield prior to its opening and to discuss the work with the officials and engineers involved. It soon became clear how great was the Government's belief in the future when the decision was taken, in the midst of the Mau Mau emergency in 1953, to go ahead with the £2½-million plan to build a modern airport for Nairobi at Embakasi. True, Kenya's capital already had two airfields, one at Nairobi West—now renamed Wilson Aerodrome in honour of Kenya's great pioneer of air transport, Mrs. Florence Kerr Wilson—and the other the R.A.F. airfield at Eastleigh. Both are close to the city, but neither could handle modern aircraft in all weathers, all the year round.

Kenya's air traffic figures are growing steadily. A cursory glance at a World map shows that Nairobi's position, 100 miles south of the Equator, is such as to give it a key placing in international air network. Since 1946 there has been a steady increase, at the rate of 17,000 passengers per annum, in the air traffic through Nairobi. The estimate for 1960 is 260,000—or 330,000 by 1964.

The job of building the new airport was given to the Public Works Department, but at an early stage this Department was absorbed by the newly formed Ministry of Works, the political head of which is Mr. Ibrahim Nathoo. He and the Ministry staff, under the Permanent Secretary, T. C. Colchester, have much of which to be proud. The architect of the new airport is H. R. Thompson, whom we found in the lofty hall, decorated with airlines' insignia, which houses the processing and Customs desks. He told us of the special steps taken to ensure the speedy processing of passengers and baggage. We found Alan Johnston, Resident Engineer, out on the fine 10,000-ft. runway.

Over the whole area the treacherous black cotton soil was excavated to an average depth of 30 in. to the solid lava bed beneath. Layers of large boulders were then crushed into place, after which a layer of smaller stones were packed by hand to ensure perfection of grading and the camber for drainage. The whole surface was then covered with bitumen. The Load Classification Number is 100—thus satisfying Class 1 airport requirements.

February, incidentally, is the driest month in Kenya's calendar, but this February all records were broken by a 12-in. downpour in one hour. Imagine what this inundation meant to the strained teams, working against time.

Air transport facilities in Kenya are the responsibility of the Minister of Commerce and Industry, Arthur Hope Jones, and responsible to him is the airport commandant, T. R. Thomson. The control of civil aviation is the business of a High Commission, a somewhat loosely jointed body performing certain common services for Uganda, Tanganyika and

The new airport terminal building seen from the north-west, with the single 10,000-ft. runway passing across the background. This picture was taken while construction of the terminal area was in progress.

As seen from the south, this aerial view of the terminal shows the main entrance for disembarking passengers in the covered way in the centre of the building running on to the apron. A plan of the airport is reproduced on p. 347 with a description of its various facilities.

Another view of the terminal building under construction; it has been designed to deal with an annual average traffic flow of more than 300,000 passengers.

Kenya; responsible to this Commission is the Director of Civil Aviation, Stacey Colls, formerly Royal Navy and a test pilot at Boscombe Down. As Embakasi is set in the vast Athi Plain, with unencumbered approaches, he humorously commented that about the only obstructions qualifying for red lights were giraffes in the National Park alongside.

The first landing by a B.O.A.C. Britannia was scheduled to take place at Embakasi on March 10 and long-range Britannias, cutting the journey time down even more, are scheduled for July this year—but what all Kenya is waiting for are the B.O.A.C. Comets, scheduled for introduction on the route in 1960, which will bring Nairobi within 10¼ hours' flying time of London.

When the misfortune to the Royal Super Constellation—reported here as a cylinder-head blown through the cowling—was known, the scheduled opening was impossible and when later news confirmed the fact that a refuelling stop would be made by the Super Constellation at Entebbe, by-passing Embakasi, the decision was taken by Sir Evelyn Baring, the Governor, to open the airport himself. This he did on Sunday, arriving before the royal dais in a Bell helicopter operated by Spartan Air Services.

Long before that 20,000 people, Europeans, Africans and Asians, had been converging on their fine new airport, which stood splendid in bright colour schemes in the clear Kenya air. Thousands thronged the apron to inspect the splendid array of aircraft drawn up in a hollow square, but most were to be found before the B.O.A.C. Comet 2E and the two R.A.F. Vulcans.

As a spectacle it certainly surpassed anything seen at home. Reluctantly the crowd of many races allowed themselves to be shepherded off the apron. The Governor read a telegram from the Queen Mother making known her distress at her inability to open the airport and her intention to come there soon on a new voyage.

After he had declared the airport open, "Miss Kenya," John Carberry's 34-year-old D.H.51, climbed into the air and the show was on. The timing was good and the commentary excellent. The organizers, Dunford, Hall and Partners, had every reason to be pleased, though many will share their regret at the non-participation by the national airline of Kenya. The take-off of the Comet 2E stole the show in local estimation, closely followed by the R.A.F. Vulcans, which came from Entebbe and demonstrated their speed by flying from Kilimanjaro in 13 minutes.

The Comet 2E was one of two which B.O.A.C. are using for Avon development work in preparation for the introduction of Comet 4s, first on the Far East and Australia runs, in 1959, and then to South Africa, in 1960.

It was flown to Embakasi by Capt. T. B. Stoney, D.F.C., manager of the Corporation's Comet Flight. Also on board were Capts. A. P. W. Cane and R. E. Millichap, the deputy manager of the Flight. For some months now the 2Es have been making daily flights between London and Beirut—a total out-and-home distance of 4,500 miles. The aim is to complete 3,500 hours' of flying (involving 7,000 hours in all with the Avon 524, two of which are fitted in each aircraft) by the end of May this year. Between August 29, 1957, and March 5, 1958, incidentally, the 2Es completed 2,350 hours and the inter-overhaul period for the 524s has already been permitted to increase from 200 to 500 hours.

Long after the show at Nairobi's fine new airport, the airport restaurants and bars were thronged. The roads home were like those at Farnborough time.

AIR TRANSPORT

B.O.A.C. Seek Paris Rights

IN ORDER to compete more effectively with foreign airlines operating between European cities and North America, B.O.A.C. have asked for permission to operate a normal scheduled service between London Airport and Le Bourget. The application to the Air Transport Advisory Council follows closely upon the agreement between B.E.A. and B.O.A.C. (see THE AEROPLANE, January 31, 1958, pp. 135-136) permitting the latter to operate through any point in Europe.

B.O.A.C. have asked approval to operate, initially, two return flights a week between London Airport and Le Bourget with DC-7Cs. The licence is sought from April 1 next for a period of 10 years, and asks for a maximum frequency of seven flights a week. Britannia 312s and Boeing 707s are specified as optional equipment.

B.O.A.C. already operate in parallel with B.E.A. from London to several European cities, including Rome, Zurich and Frankfurt, on their routes to the Empire and Far East. The London-Paris rights are intended, clearly enough, to serve as an extension of the Atlantic services, and may prove to be the first of several such extensions planned by the Corporation. At present, passengers who choose to cross the Atlantic by B.O.A.C., but who are travelling to or from the European mainland, have an annoying change both of aircraft and terminals at London.

It seems unlikely that B.E.A. will lose much traffic to B.O.A.C. on the London-Paris route, since few travellers journeying simply between the two cities would choose to travel on the long-haul service, and it would not be in B.O.A.C.'s interest to seek such traffic.

Cyprus and B.E.A.

AT the end of January a new operating agreement between British European Airways and Cyprus Airways came into effect. Since February 1 the latter has ceased to operate its own aircraft and all services are now being flown under a charter arrangement with the Corporation. Previously, B.E.A. had flown Cyprus Airways' services between Athens and Nicosia as a section of the London—Cyprus services.

This arrangement—though immediately the result of unsettled conditions in the area—has been under consideration for some time. Not only has there been the prospect of difficulty in replacing Cyprus Airways' DC-3 fleet, but such a relatively small operating unit would obviously have had continued problems in terms of aircraft utilization and costs. Integration of the services with those of another carrier has always been attractive as a possible future policy for Cyprus Airways and the difficult political conditions have done no more, apparently, than to hasten the inevitable.

A Disappointing Month

B.E.A.'s winter traffic results have been generally disappointing and the total traffic for January showed no more than a 6% increase on that for the same month of 1957. Preliminary estimates suggest that the Corporation's loss for January will be more than £600,000—the greatest loss ever suffered in a single month.

A record profit for the financial year, 1957-58, is, however, still expected, following good summer results and a careful watch on expenditure.

The Airlines and Apron Requirements

IT is 1958; the big turbojet transports will be with us in less than two years from now. The majority of the essential ground facilities for 1960 must already be planned and under construction.

But there is still time for interim modifications—and new airports and airport buildings will continue to be developed in the future. So the latest document from the technical secretariat of the International Air Transport Association is well worth while even though it may not necessarily be of much help in the earlier, critical period of the turbojet era.

This document—outlining the probable requirements for airport aprons*—follows and supplements the airport-planning handbook** produced by the Association in July, 1956. It deals with the overall problems and requirements for any airport where the turbojet giants will be calling and discusses passenger/freight handling and fixed service proposals for the coming era.

In general, the decisions are left to the airport authorities, but here and there the demands of the airlines are made plain and no doubts are left about the way in which arrangements

VANGUARD TO THE FORE.—The completed fuselage of the first Vickers Vanguard has now been moved forward to the final assembly area at Weybridge, and, as this picture shows, the wing torsion boxes have been added. More Vanguard fuselages are taking shape in the jigs visible in the middle distance.

* "Apron Requirements for Turbine-powered Aircraft."
** "Airport Buildings and Aprons."
(Both published by the Technical Secretariat, International Air Transport Association, Terminal Centre Building, Montreal 3, P.Q., Canada.)

should be made. For instance, despite the different attractions of movable fenced walkways, under-apron tunnels with sub-terminals, and "open" systems, using vehicles for passenger and freight movement, IATA seems to be positive in its belief that the now almost universal pier-finger system offers the best compromise.

The section dealing with fixed servicing installations, such as hydrant fuelling and power systems, is interesting in that it shows how varied the problems are for the airport planner. Even in the relatively simple matter of hydrant points, a diagram, in which 10 aircraft plans are superimposed, shows the wide variations in under-wing refuelling points in relation to nosewheel positioning points. The variation in electrical power requirements suggests the need for a main power supply which would be regulated by mobile converters.

Unfortunately, aircraft-wheel-drive taxi-ing devices are still insufficiently developed for IATA to take any positive stand—but the impression gained is that such devices may be the best answer to many of the noise and towing problems on the apron. When fully developed and proved to be reliable, these systems will allow the powerplants to be cut when the aircraft is well away from the terminal buildings and will leave the aircraft under the full control of the flight crews while manœuvring towards and away from the terminal standings.

The New Nairobi

WHEN, on Monday of this week, Nairobi's new airport at Embakasi came into preliminary operational use, the event was by way of being the culmination of the latest series of developments in more than 30 years of commercial aviation in East Africa.

In 1926, a strip at Dagoretti Corner, on the western side of the town, was the first to be used; in 1935 Nairobi West was laid out; and in 1937-40 the airport at Eastleigh was built by the R.A.F. This has been the international airport until now, though Nairobi West has been used as a base by East African Airways and will continue to be used in the future for non-scheduled operations.

The site at Embakasi on the Athi Plains was developed because, among other reasons, Eastleigh could only be extended at great cost, and was finally chosen in 1952—though the site had been suggested for use as an airport even in pre-war days, before the construction of Eastleigh. The outline scheme for Embakasi was described in THE AEROPLANE of May 23, 1952.

Because no frontal weather systems are involved, Nairobi has only two seasonal directions for winds of any appreciable strength (during the north-east and south-east monsoons) and even these winds, so far from the coast, are not strong by European standards. Only one runway direction is, therefore, necessary, and a compromise between wind direction and siting problems resulted in a runway aligned 06/24.

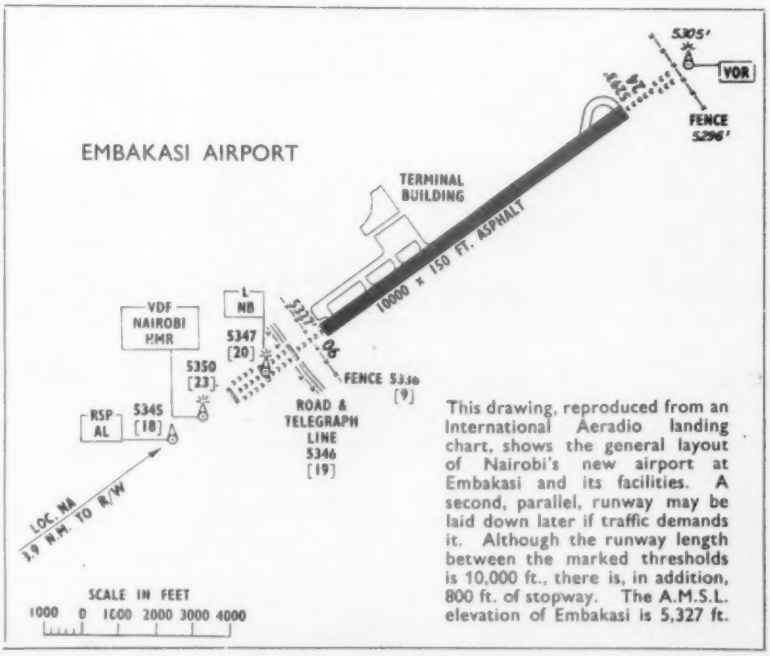
This runway is 10,000 ft. long between the marked thresholds, with stopways, or overruns, of 200 ft. at the south-west end and 600 ft. at the north-east end; additionally there are cleared areas of 800 ft. and 1,400 ft., respectively, at each end.

Because of the prevailing wind conditions, about 95% of aircraft movements will be at the south-west end of the runway and it is here that the apron, holding, taxiway and terminal areas are situated. There is low-intensity red centre-line approach lighting and green threshold lights at each end of the runway with, as it will be that normally used, cross-bar lights on the approach from the south-west end. The runway has the usual low-intensity white omni-directional lighting, the last third of the runway having amber coloured lights. Radio navigational aids include VOR, a VDF homer and a responder beacon for use primarily by B.O.A.C., whose Britannias have DME equipment.

Constructional work started in January, 1954, and the entire project should be completed by September of this year, though the airport will be operational from March 10. The runway was initially designed to Class 3 standards, but bearing tests have since shown that it is capable of loads up to Class 1 standards. The first step in the work on the site involved the excavation of all the black cotton soil over the basic strip area of 10,800 by 500 ft. followed by the excavation also of the well-known Athi Plain "craters," 50-100 ft. in diameter, of which there were 40 in the runway area alone.

The design of the terminal has been based, after careful consideration of traffic requirements and trends, on attractively simple principles. A total annual traffic flow of about 260,000 passengers can be expected by 1960 and about 330,000, at the most, by 1964. In a peak hour there might be 600 transit passengers and 600 arriving or departing passengers. Consequently, it was possible to plan the terminal while using the simplest system of arrival and departure channels. The building is divided along its length by a Customs barrier, and transit and departure passengers will use the same area. In order to reduce congestion and inconvenience it was agreed that it would be possible for departing passengers, after their luggage had been cleared by Customs, to remain outside the air-side area until called by loudspeaker, when a final Customs check of hand baggage would, if necessary, be all that was required for final clearance.

All handling, outbound and inbound, is done at ground-floor level, with a subway for the baggage movements. When and if necessary, extensions to the building will be relatively simple, but it is not expected that these will be required before 1965 at the earliest.



This drawing, reproduced from an International Aeradio landing chart, shows the general layout of Nairobi's new airport at Embakasi and its facilities. A second, parallel, runway may be laid down later if traffic demands it. Although the runway length between the marked thresholds is 10,000 ft., there is, in addition, 800 ft. of stopway. The A.M.S.L. elevation of Embakasi is 5,327 ft.

Turbojet v. Turboprop Economy

The relative earning power of turbojet and turboprop aircraft is still a subject for lively discussion. MR. STEPHEN WHEATCROFT, *economic adviser to B.E.A., here sets out some of the basic factors to be considered in making such comparisons. His remarks first appeared in "Shell Aviation News" as part of a longer article in which the case for differential fares was also argued.*

ALTHOUGH I fully agree that the earning power of turboprop and turbojet aircraft is a factor of enormous importance in air transport economics, it seems to me that some people, far from neglecting this factor, are trying to count it twice in the economic equations. They want to count productivity as a cost-reducing factor and also as a revenue-earning factor. In most cases, though not in all, this is double counting and it is desirable to try to clear up some of the confusion which has surrounded this issue in recent discussions. I will not attempt to refute any particular argument but I will try to establish the economic significance of earning power as a factor in aircraft evaluation.

Let me make it clear that I fully accept that there is a useful—indeed, vital—distinction to be made between productivity and earning power. Productivity, the annual output of an airline aircraft in terms of ton-miles or seat-miles, is one of the most important factors in determining the level of operating costs. The saleability of those ton-miles or seat-miles is, of course, equally important from an economic point of view and it is this aspect of earning power which I accept as an independent factor in the evaluation of different types of aircraft. I do not think, however, that this is quite the sense in which earning power has been used in some contributions to the recent jet versus turboprop controversy.

Productivity, as defined in the previous paragraph, is determined by three factors: size of payload, average speed and utilization. It is important to note that whereas increases in size and utilization usually lead to a fall in the unit cost of operation, an increase in speed, unless it comes solely from drag reduction, may lead to an increase in the unit cost of operation. On the other hand, when we look at the influence of these same three factors on earning power, it is apparent that excessive increases in size and utilization may have an adverse effect upon the load factor achieved, whereas an increase in speed almost always leads to an increase in the traffic volume.

Arguments have been used which suggest that even if the revenue rate were the same in both cases (i.e. the same fares charged and the same load factor achieved) a faster, more productive aircraft may be more profitable than a slower one even if the faster aircraft is rather more expensive to operate. Productivity, it is claimed, influences earning power even in these circumstances.

This argument is based, I believe, on reasoning along the following lines. Let us compare, it is suggested, two aircraft of the same size (100 seats), one of which is a jet which cruises at 575 m.p.h. and the other a turboprop which cruises at 350 m.p.h., and consider their operation over a stage distance of 1,000 miles. It is agreed that the jet operating costs (total cost per seat-mile) are 10% higher than those of the turboprop. A comparison is then made along the lines shown in Table 1.

Table 1.—Turbojet and Turboprop Profitability.

	Turbojet	Turboprop
Cruise speed	575 m.p.h.	350 m.p.h.
Block speed (1,000 miles)	460 m.p.h.	290 m.p.h.
Seat-miles per hour	46,000	29,000
Total operating costs per seat-mile	4.4d.	4.0d.
Revenue per seat-mile(1)	5.2d.	5.2d.
Surplus per sea.-mile	0.8d.	1.2d.
Annual surplus per aircraft(2)	£368,000	£348,000

(1) Assuming revenue rate of 7½d. per passenger mile at 70% load factor.
(2) Assuming 2,400 hours per annum utilization.

The jet aircraft, despite its higher operating costs, is therefore shown to produce a larger annual profit than the turboprop. But there is surely a fundamental fallacy in this approach. The airline is not primarily interested in the profit per aircraft: it is interested in the profit from its total operations. In a case of this sort, where it is assumed that the traffic volume is unrelated to the aircraft used, the airline will use more turboprops than jets and so, although it earns a smaller profit per aircraft, its total profit from its operations will be greater with turboprops than with jets. If, for example, the airline produces just over a billion seat-miles a year, it can produce these either with 10 jets or 16 turboprops. In the jet case its annual profit will be £3,680,000 and in the turboprop case it will earn £5,568,000.

Let me make it quite clear that I am not supporting the unrealistic assumption that the revenue rate and the traffic volume are unrelated to the type of aircraft used. All I have tried to do in this first section is to show that those who make these assumptions and yet claim that the higher cost, faster aircraft is more profitable than the lower cost, slower aircraft are confused by the irrelevant factor of profit per aircraft. If other things are equal the aircraft with the lowest seat-mile costs will always be the most profitable.

But of course other things are rarely equal and speed, particularly in competitive conditions, is likely to influence both the traffic volume and the seat-mile revenue of any airline. It is a consideration of these influences, and not the

A recent picture of the Lockheed Electra, America's first turboprop transport and one of the aeroplanes concerned in the controversy over economy. The author maintains, in this article, that, with the same traffic offering, the turboprop airliner is fundamentally more profitable than the turbojet.

The second Boeing 707-120, in the new fleet colours of P.A.A. Mr. Wheatcroft argues that the turbojet is less profitable than the turboprop when all else is equal and despite its higher profitability per aircraft. However, the higher speed of the turbojet often influences traffic volume and seat-mile revenue so as to cancel out this disadvantage.

profit per aircraft, which has led so many airlines to decide that they cannot afford not to have jet aircraft.

Before giving further thought to the speed/traffic relationships which are so important to the airlines today, it may be necessary to take a look at another argument which says, in effect, that even if the seat-mile revenue is a constant factor, the seat-mile operating costs may not tell us which is the most profitable aircraft. It is sometimes argued that the relevant consideration is what has been called the "Aircraft Economic Parameter." This parameter is defined as the ratio of the annual operating profit which an aircraft will generate as a percentage of the initial investment in the aircraft. This approach has some merit, particularly because it emphasizes the importance of capital costs, but its merits seem to me to be outweighed by its dangers. The first danger is that it may lead to exactly the same sort of confused thinking as the "profit per aircraft" approach. The other dangers are, on the one hand, that it ignores the fact that the investment in the aircraft is only a part of the total airline capital and, on the other, that a variation in the seat-mile revenue may completely reverse the conclusion reached about the relative profitability of different aircraft from a consideration of their comparative economic parameters.

As an example of the second of these dangers let us return to the case of the two aircraft compared in Table 1. If these two aircraft both cost £1m. (an unfavourable assumption for the turboprop which is almost certain to be cheaper than the jet) then the profit on the capital invested in the aircraft will clearly be 36.8% for the jet and 34.8% for the turboprop. Investment in aircraft is, however, about 60% of an airline's total capital, and the proportion will vary if we are comparing the case of a jet operation and a turboprop operation of identical size since the capital, other than aircraft, will be approximately the same in both cases. Thus the total capital required, and the rates of profits of the billion passenger-mile airlines compared in the earlier example will be as shown in Table 2. Thus, on the total investment, the turboprop may give a higher rate of return even though the comparative economic parameter shows the jet to be the most profitable investment.

I have chosen the figures in this example, and in the previous one, not to try to prove that turboprops are better than jets, but merely to illustrate the inadequacy of certain methods of assessment. Various small changes in the assumptions, particularly by reducing the cost differential between the turboprop and the jet, might reverse the conclusions shown in my examples. But this surely underlines my point that both the "profit per aircraft" and the "aircraft economic parameter" are inadequate guides in aircraft economic evaluation.

Table 2.—Rate of Profit on Total Airline Investments

	Turbojet Operation	Turboprop Operation
Capital—Aircraft	£10m	£16m
Other	£6.7m	£6.7m
Total	£16.7m	£22.7m
Profit	£3.68m	£5.568m
Rate of Profit	22%	24.5%

My further objection to the aircraft economic parameter is that the assumption of a constant revenue rate is unrealistic. It is precisely because the revenue rate is a variable factor in economic evaluation of aircraft that the economic parameter method can be a dangerous guide. An airline might well conclude from using this method that aircraft A, even though it has higher specific operating costs, gives a better return on investment than aircraft B. But what if a competing airline buys aircraft B and, because of its lower operating costs is able to reduce the fare level? The profit margin on which the decision to buy aircraft A rested may be drastically reduced. Indeed, the operation of aircraft A at the new fare level may even result in a loss. This reveals the fundamental weakness of the economic parameter method. Economic evaluation of different aircraft must be a dynamic, not a static analysis.

Capital Costs

The chief argument in favour of this method of aircraft evaluation is that it draws attention to the importance of capital costs. Neither the S.B.A.C. nor the A.T.A. cost formulæ take account of interest on capital, and this is a serious omission. There is no reason, however, why interest on capital should not be included as an operating cost. Without getting involved in economists' arguments about when interest is, or is not, an operating cost, it can be said that in making an assessment of any new investment it is essential to include the current rate of capital earning in alternative employments as a cost of the proposed investment. It is this cost which the rate of interest is supposed to reflect.

Let us now abandon the assumption that the revenue rate is a fixed factor in economic evaluation of different aircraft and consider some of the problems which face the airlines in their present assessments of jets and turboprops. We will continue to assume that the seat-mile operating costs of the jet are 10% higher than those of the turboprop. It is fairly obvious that if the fare level is the same for the two types of aircraft, the revenue rate in a parallel operation will be higher for the jet than for the turboprop because the jet will carry more traffic. This will probably be true for all stage distances, even the very shortest, but it will be an increasingly important factor as stage length increases and the saving in journey time offered by the jet gets progressively larger. On the short-haul routes the turboprop will probably be able to hold its ground and remain economically attractive because the jet's advantage in load factor may not be large enough to outweigh the turboprop's advantage in operating costs.

On the longer routes, however, there seems little doubt that the competitive attraction of the jet, and therefore its higher revenue rate, will outweigh the cost advantage of the turboprop and the jet operation will be the more profitable. It is for this reason that so many of the World's airlines have decided that the earning power of the jets is more important than the lower costs of the turboprops. Earning power, in this sense, is the ability to bring in a higher revenue rate per seat-mile and is quite independent of aircraft productivity as a cost factor.

Canada's New Airline Policy

WHEN a country throws the routes of its Government airline open to competition, one would expect cries of jubilation from private airline operators. Such has not been the case, however, in Canada following Transport Minister Hees' recent announcement in Timmins, Ont. The operators are only too keenly aware that the decision may be reversed if a Liberal Government is elected on March 31. Equally sobering are the working capital statements of some of the airlines.

The public and the newspapers seem to have welcomed the change. Editorials speak of a new air age of Canada, and of services for dozens of small cities now without air transport. Such is the enthusiasm that the economic reasons why these places are without airlines are never mentioned.

Although the newspapers have been more rhapsodical than logical, the policy change is a most important one. Applications for international routes—previously reserved for Trans-Canada Air Lines, "the chosen instrument"—will now be considered on their merits by the Air Transport Board. Canadian carriers will not compete with each other on international routes, but this will be allowed domestically "where economic conditions indicate that more than one operator can carry on successfully without Government subsidy." Private airlines granted the advantage of competition will be expected to assume greater responsibilities for services to remote, unprofitable points.

To Canadian Pacific and Pacific Western, the second and third largest airlines respectively, the new policy means a serious chance of getting a licence for trans-continental service, for which both applied months ago. Air Transport Board hearings should start in public shortly. After studying the evidence, the Board will make a recommendation to the Minister of Transport on whether a need for the service exists and whether an airline could be expected to make a profit. The ministerial and cabinet decisions might take a year.

The Government's decision is being privately welcomed by not a few T.C.A. officials. They reason that as soon as passengers have another line with which to compare T.C.A. service there will be fewer complaints. Like most monopolies, T.C.A. has received more than its share of criticism. Every Vancouver-bound editorial writer whose luggage has been deplaned en route has written of the airline's "cavalier attitude." Businessmen deplore the departure times; three of the seven daily West-bound flights out of Toronto leave between 12.45 a.m. and 3.40 a.m. There are additional complaints about lack of space and reservations.

The inconvenient departure times are dictated by T.C.A.'s understandable passion for high equipment utilization, and the desires of the biggest single customer, the Post Office. On the point of available space, however, even Mr. Hees is critical. "In the past," he said, "T.C.A. acquisition of aircraft did not keep abreast of the growth in passenger traffic, and T.C.A. had too few aircraft for the passengers travelling."

T.C.A. has predicted traffic growth with some accuracy, but the planners have not believed the forecasts of the sales department. The belated revision of forecasts has been reflected in the continual reordering of Super Constellations, and in the increase in flight frequencies on various routes. What may seem excess caution has resulted from an insight into the sagging market for used aircraft, and the forthcoming turbine era. Rather than spend money on obsolescent Convairliners, T.C.A. chose to be the last major airline in North America to operate DC-3s—a situation which would not have existed if there had been competition.

Equipment has been so short that the company's staff has often had only "the corners of the box" to sell. Trans-continental all-freight service was introduced only after C.P.A. applied for a licence to operate a similar service with DC-6As, which were sold when the licence was not granted. Although there have been recent reductions in tourist fares, this class of service has not been promoted as zealously as in the U.S.A.

On the other hand, T.C.A.'s conservatism has built a strong, able organization. Passenger comfort has been considered more than one might expect in a monopoly. For example, North Stars were operated as 40-passenger aircraft when American airlines were packing 15 or 20 more seats into their comparable DC-4s. Four-abreast seating has been retained on first-class flights, despite lack of capacity (and competition). Improved catering, better tourist service than in the United States and other innovations have been made without the spur of competition. But there are no champagne, orchids or perfume, as in the U.S.A. Thus T.C.A.'s policy can be described, depending upon one's bias, as backward or, at best, progressive conservative, like the present Government.

Private operators can now bid for any of T.C.A.'s domestic runs. Because of their lower overheads, the small companies could probably operate some of T.C.A.'s marginal routes at a profit. On any route, a second airline can be expected to generate new traffic. It will take from the railways and buses traffic that previously had been turned away by the first line. It will take from T.C.A. through being able to offer more convenient flight times, in the beginning at least.

This opportunity for more business comes at a time when Canadian airlines are sliding down the business peak created by the Mid-Canada and the DEW Line airlifts. Many of the Commandos, DC-3s and Yorks hurriedly gathered from Iran to Ireland for these great Northern projects are now standing idle at Dorval and other airports. Maritime Central Airways, which had great hopes for its transatlantic charter business, is now reported to be trying to sell the two DC-6s it has on order. Other airlines are agitating for more mail pay, and there has been talk of taking over the R.C.A.F. Transport Command's scheduled flights. Understandably, the Air Force is something less than enthusiastic about such proposals, and it has underlined its viewpoint by ordering an uneconomically small quantity (10) of Canadair CL-66 Cosmopolitans, Eland-engined versions of the well-known Convairliner.

Even if the new policy is not reversed by a new government, it may be many months before it is converted into aircraft orders, hangars and reservations facilities. There is additional uncertainty because it is not known how much stress will be placed on the report on Canadian aviation economics by the British consultant, Stephen Wheatcroft. Meanwhile, there may be some distress selling of aircraft if operators cannot persuade the post-election Government that they need faster action and more mail pay, or a subsidy.—NEIL A. MACDOUGALL.

NOTABLE QUOTES . . .

. . . from the speech by the Hon. George Hees, Minister of Transport, on February 7, 1958.

■ ***International Routes***

"Requests put forward in the future will be treated on their merits, and additional international routes or points of call may be authorized."

"It is not intended to place T.C.A., C.P.A. or other Canadian airlines in competition with each other in the international field."

"There is room for development of international charter services by other Canadian operators."

■ ***Trans-border Routes***

"In future, where a new trans-border route to the U.S. is available for operation, the most suitable Canadian carrier will be selected."

■ ***Domestic Routes***

"I have proceeded on the assumption that competition is a valuable stimulus to more efficient operation and to the provision of better service to the public."

"I am satisfied that the gradual introduction of some measure of competition in our domestic scheduled services should not be denied."

"The objective will be the introduction of competition on domestic air routes on a gradual basis where economic conditions warrant."

"It is reasonable to expect that private airlines also if granted the advantage of competition should in future assume greater responsibilities for service to points which need air service, but are not self-sustaining."

NEWS IN PICTURES

The ultra-light Kolibrie (above) produced by N.H.I. at Rotterdam has just received its certificate of airworthiness—the first ramjet helicopter in the World to do so.

Above, a Sikorsky HR2S (S-56) helicopter of the U.S. Marines lifts most of an HSS (S-58) during a recent demonstration at New River, N. Carolina. Left, the second Lockheed Electra turboprop airliner (nearest camera) was joined on its maiden flight at Burbank on February 13 by the first aircraft, which was making its 49th flight. The Electra is scheduled to begin commercial service in November. Another photograph of the prototype is on page 348.

Below, Russian-designed Antonov An-2 7/10-passenger biplanes are in service with East Germany's Deutsche Lufthansa. Right, first photograph of the Model 16½ ducted-propeller VTOL aircraft produced by the Doak Aircraft Co., a description of which we published on February 28.

Below left, mention of the Malayan Air Force in the recent Air Estimates adds topicality to this picture of Malay Auxiliary pilots in the Singapore Wing. One of their instructors, Flt. Lt. D. Freeman, is on the left. The Auxiliaries fly Chipmunks at Tengah.

Photograph copyright "The Aeroplane"

Below, a Sikorsky S-55 (H-19C) destined for operation by Okanagan Helicopters on the Mid-Canada Line.

Howard Levy photograph

Experimental Aerodynamics for NATO

RESEARCH into aerodynamics is one of the most absorbing problems of aeronautical endeavour in two senses. Not only is it one of the most interesting and rapidly advancing applied sciences but it also requires an increasing number of alert and inquiring minds to work at it. To increase the number of both experimental installations and aerodynamicists well versed in experimental research techniques, the Training Center for Experimental Aerodynamics (TCEA) has been established at Rhode-Saint-Genèse, near Brussels, under North Atlantic Treaty Organization (NATO) auspices.

Prof. R. P. Harrington, Technical Director of TCEA.

The need for technicians and facilities for experimentation was seen by Dr. Theodore von Kármán, who has for some years been chairman of the Advisory Group for Aeronautical Research and Development (AGARD) to NATO. He pointed out, late in 1955, that the problem could be solved only by a combined effort by all NATO countries.

An existing aeronautical research establishment at Rhode-Saint-Genèse, a suburb of Brussels, suggested itself as being particularly suitable. The location was both convenient and pleasant, and the Belgian Government gave its approval to the plan. Dr. von Kármán appointed a Study Group to investigate the possibilities offered by the suggested establishment—Prof. F. Haus of Belgium, Prof. L. Malavard from France, Prof. A. D. Young from the United Kingdom and Prof. C. Zwikker from the Netherlands. Mr. R. A. Willaume, Director of the International Exchange Program, was the AGARD representative to the Study Group, which agreed on suitability of the site and outlined an educational programme.

Opening on October 15, 1956, the TCEA (or CFAE—Centre de Formation en Aérodynamique Expérimentale) has for the first three years of its life the joint support of the Belgian Government and the Mutual Weapons Development Program of the U.S.A.

The aims of TCEA, which is incorporated as an international scientific association, are:—

1. To give scientists and engineers from the NATO countries a specialized training in the techniques and practice of a modern aerodynamics laboratory.

2. To contribute to the dissemination of knowledge in the field of fluid mechanics and, more particularly, of experimental and applied aerodynamics; and

3. To encourage the practice of research work in the field of experimental aerodynamics and fluid mechanics.

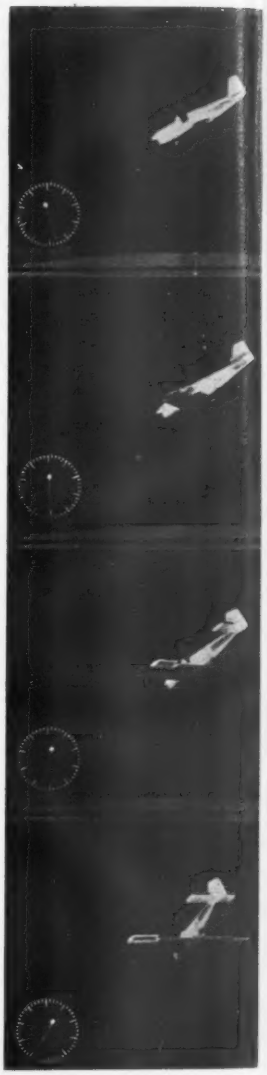
Training given at TCEA is at post-graduate level and is planned to augment and complement—rather than to duplicate—that provided at other aeronautical establishments. It is also intended to be of direct use in other industrial and research application for which experimental techniques similar to those found valuable in aeronautics would be useful.

The course lasts for nine months, starting in October, and is open to engineers and scientists of NATO countries. No tuition fees are charged and there is a limited number of scholarships available to students on the basis of merit and financial need to meet living expenses.

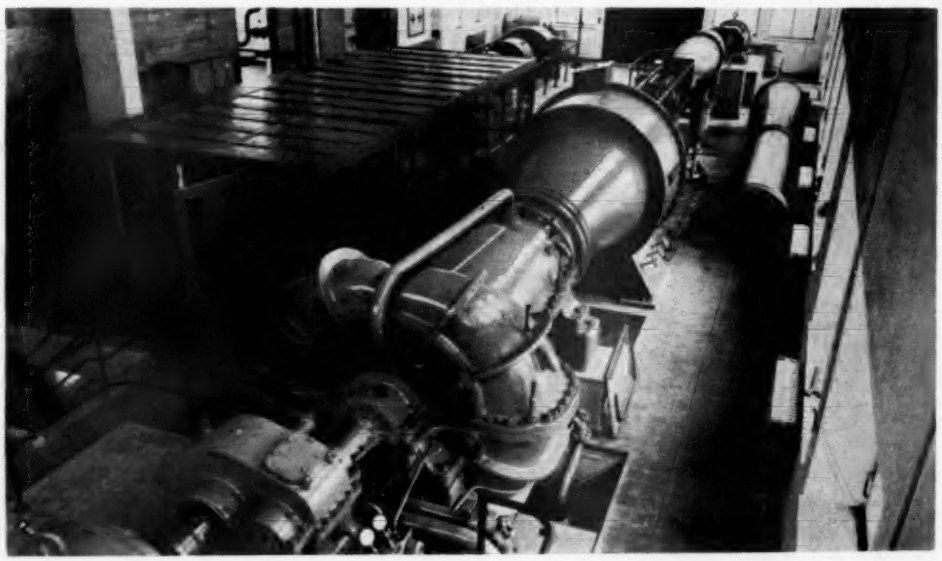
Organization, Staff and Curriculum

General management policies are framed by a Board of Direction consisting of the following members: Dr. von Kármán (chairman); M. P. Nottet (vice-chairman), director-general of the Civil Aeronautics Administration (Belgium); Prof. F. Haus, University of Liège and University of Ghent (Belgium); Prof. L. Malavard, Chair of Aeronautics, Sorbonne, University of Paris (France); M. Max Freson, secretary of the National Scientific Research Fund (Belgium); Prof. J. Ducarme, University of Liège and chief engineer in the Civil Aeronautics Administration (Belgium); Prof. A. D. Young, Chair of Aeronautical Engineering, Queen Mary College, University of London (United Kingdom); and Prof. C. Zwikker, Director of the Eindhoven Technical Institute (Netherlands).

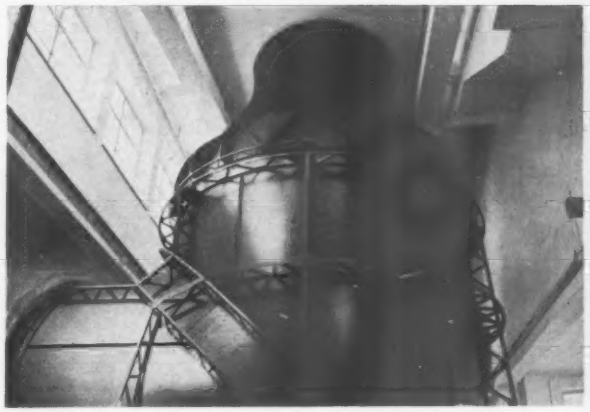
The academic staff under the technical director, Prof. R. Paul Harrington, Sc.D., on leave from the Rensselaer Polytechnic Institute



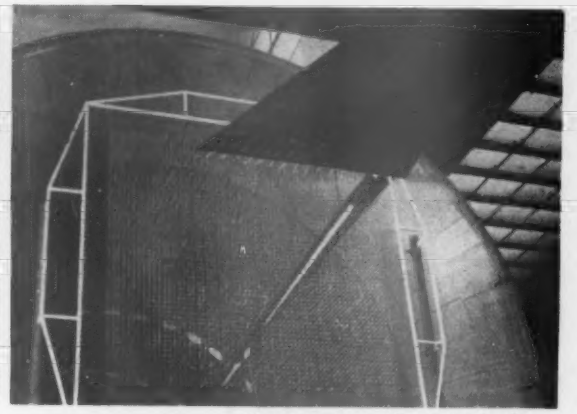
Above and on the opposite page is a sequence showing half a spin performed by a model Tipsy Junior.



Left, the Brown-Boveri supersonic wind-tunnel to which has recently been added a transonic working section with slotted throat.



A spin tunnel is formed when the nozzle of the low-speed Escher Wyss wind-tunnel is rotated upward through a right-angle.



Photograph copyright "The Aeroplane"

The Escher Wyss tunnel can be used in closed circuit or with open jet as here, where the tip vortices behind a delta wing are shown by the screen wool tufts.

(U.S.A.), consists of Prof. Robert H. Korkegi, Ph.D. (U.S.A.) (assistant technical director), Prof. Paul E. Colin, B.Sc., M.E. (Belgium) (associate director), Prof. Jean J. Smolderen, Sc.D. (Applied) (Belgium), and Prof. Jean J. Ginoux, Sc.D. (Applied) (Belgium).

From time to time, eminent scientists and engineers from NATO nations are invited to TCEA as guest lecturers on subjects on which they are expert.

About three-quarters of the students' time is occupied by laboratory work on instrumentation, preparing and making wind-tunnel tests. There are complementary lectures as an introduction to the experiments including brief reviews of the basic theoretical concepts in the fields of aerodynamics and electronics. Before and after each experiment there are discussions on the work and this exchange of ideas is encouraged.

Students work in small groups with a rota system of group leadership and can thus receive individual attention and personal guidance from the staff member supervising the particular experiment and also gain experience in planning and directing experimental work which involves the design, construction and testing of an instrument, model or wind-tunnel component. The individual projects of the current course of first-term students include a photo-electric displacement-measuring device for non-steady flow problems; a multi-manometer for a supersonic wind-tunnel; a supersonic biconvex aerofoil with pressure orifices; a yaw meter for subsonic and supersonic flow; a supersonic low-drag body of revolution; a wake-survey rake and integrating device mechanism (low speed); similarity-adjustment of a model for the spin tunnel; hot-wire probes and actuating mechanisms for boundary layer investigations.

Two of the students, Aristides Pasaliakos and Constantinos Sotiropoulos, will return to Greece with a design for a low-speed wind-tunnel to be built there. This is an excellent example of the great use of TCEA to those countries with little or no facility for aeronautical training. At present the course contains students from Greece, the United Kingdom, Denmark, Western Germany, Italy and Belgium.

During the academic session, various visits are arranged to other aerodynamics research establishments in other NATO countries. Instruction is given in both English and French and the staff are all at least bilingual. Plans are under way for more advanced short courses on specialized aspects of experimental aerodynamic techniques as required by the various NATO countries

The full course of study covers basic instruments for subsonic and supersonic wind-tunnels; calibration of low-speed wind-tunnels, determination of wall corrections and calibration of supersonic nozzles; methods of flow visualization; calculations of wind-tunnel elements; basic electronics; measurements in steady flow (subsonic and supersonic); measurements in non-steady flow; spin tunnel tests; boundary-layer measurements in subsonic and supersonic flow; transonic and hypersonic aerodynamics.

Research Equipment

There are three wind-tunnels at present in operation, although this figure is misleading because one is of the composite multi-purpose type and another is an old Eiffel-type "open-return" tunnel soon to be dismantled.

The Brown-Boveri supersonic wind-tunnel is of the Ackeret type. It can operate continuously in closed circuit, powered by a 13-stage axial compressor driven by a 650 to 950-kW. DC motor, up to a Mach number of 2.5, the working section being 16 in. (40 cm.) square. There is a Schlieren optical system for flow visualization. Very recently a transonic working section has been made for this tunnel, with slotted floor and ceiling, capable of operation from a Mach number of 0.5 up to 1.2 at stagnation pressures from a half to one atmosphere.

The Escher Wyss low-speed tunnel is of ingenious design in that it can be used in three different forms. It is basically a closed-circuit tunnel with a 6.56-ft. (2-m.) dia. working section and an operating speed of 394 ft./sec. (120 m./sec.). By removing a section of the tunnel, it becomes an open-jet type with a working-section diameter of 9.84 ft. (3 m.) and an airspeed of 197 ft./sec. (60 m./sec.).

By rotating the nozzle of the tunnel upward, a spin tunnel is provided. A further layout which may be used is for the free-flight testing of models in an inclined jet of air. The contra-rotating fans of this multi-purpose wind-tunnel are driven by a 580 to 850-kW. DC motor.

An interesting example of the type of wind-tunnel used in the early 1920s, the old Eiffel tunnel will make room for such equipment as an intermittent hypersonic tunnel operating up to a Mach number of about 8.0 at high Reynolds numbers. This tunnel will require a high-pressure air supply system which should be sufficient also to meet the requirements of two cascade wind-tunnels. The high stagnation temperature required will be obtained by means of a storage type heater.

Other equipment has been allocated by the U.S. Air Force. This should be delivered and some put into operation during this year. It includes low-speed, transonic and supersonic cascade tunnels for turbine-blade investigations; low-speed and supersonic instrument-calibration ducts, a low-speed test blower; and a high-speed rotor test stand.

Apart from wind-tunnels and associated equipment there are well-equipped laboratories for electronic (strain-gauge balances, pressure and temperature pick-ups, *boites à mystère*—or "black boxes"—and so on), optical and photographic work. Workshops for metal and wood machining are well enough equipped to allow most of the required models to be built at TCEA. There are a library, lecture rooms (including a fine main lecture hall), a lounge and a cafeteria.

Certainly any young man or woman lucky enough to be accepted for a course at TCEA will not regret the chance of meeting opposite numbers from all the NATO countries in surroundings as academically profitable and so pleasantly sited near the Forêt de Soignes.—D.G.

THE FIGHTING SERVICES

Combined Naval Exercises

MAJOR units of the British Mediterranean Fleet and the U.S. Sixth Fleet took part in a three-day programme of combined exercises in the Central Mediterranean last week. The exercises were designed to familiarize the two Fleets in combined operations and included air strikes from carriers, and defence against air and submarine attacks.

Commanded by the Flag Officer Aircraft Carriers, Vice-Admiral A. N. C. Bingley, the R.N. carrier group consisted of H.M.S. "Eagle" and H.M.S. "Ark Royal," which started their tours of duty in the Mediterranean earlier this year.

R.C.A.F Essay Award

A PRIZE of $250 has been offered by the *R.C.A.F. Staff College Journal* for the best article "likely to stimulate thought on military and particularly air force matters." The award is open to members and former members of the Canadian armed forces and of the civil service.

The articles, not to exceed 5,000 words, may deal with strategy, operations, training, logistics and research, or any other field, and will be judged by a committee appointed by the board of directors of the *Staff College Journal*. In addition to the cash award a payment will be made for all entries published in the journal.

African Visit

THREE Bomber Command Avro Vulcans of No. 83 Squadron, R.A.F. Waddington, are due to return to the United Kingdom today (March 14) from a tour of Kenya, Uganda and Rhodesia. Leaving their home station on March 5 the Vulcans, piloted by Sqn. Ldr. D. R. Howard, D.F.C., A.F.C., Flt. Lt. D. M. L. Lob and Flt. Lt. D. J. Mountford, staged through Wheelus U.S.A.F. Base, Tripoli, before flying on to Entebbe, Uganda, the next day.

On March 8 one aircraft was to fly to Embakasi, Nairobi, for the formal fly-past during the airport opening ceremony by H.M. Queen Elizabeth, The Queen Mother, and return to Entebbe. The following day all three Vulcans were to land at Embakasi, which was then to be open to the public; two were to be in the static exhibition with R.A.F. Shackletons and Venoms, and the third was to take part in a flying demonstration.

Two days later, March 11, one Vulcan was going to Salisbury, Rhodesia, until March 13, when it was to start its homeward flight. The co-pilot of this aircraft is Air Vice-Marshal G. A. Walker, C.B.E., D.S.O., D.F.C., A.F.C., Air Officer Commanding, No. 1 Group, Bomber Command, who is a former Senior Air Staff Officer of the Rhodesian Air Training Group. The two Vulcans remaining at Embakasi were due to leave for Waddington on March 12.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Wing Commanders: R. A. Barton, O.B.E., D.F.C., to the Air Ministry for duty in the Department of the C.A.S.; T. N. N. Brennan, M.B., B.Ch., to Headquarters, No. 23 Group, Flying Training Command, as Senior Medical Officer; L. J. Joel, D.F.C., to the Air Ministry for duty in the Department of the C.A.S.; K. F. Mackie, O.B.E., D.F.C., to R.A.F. Gutersloh, 2nd T.A.F., as Officer in charge of Administration; K. G. Major, O.B.E., to Headquarters, Home Command, for staff duties; J. M. Morgan, D.F.C., to the School of Land-Air Warfare, for liaison duties with Southern Army Command; E. B. Panter, D.S.O., D.F.C., to the NATO Defence College; J. H. G. Sarll, D.F.C., to R.A.F. Stoke Heath for administrative duties; C. K. Saxelby, D.F.C., A.F.C., to the Air Ministry for duty in the Department of the C.A.S.; A. T. Staveley to R.A.F., Greenham Common, to command, and for liaison duties with the U.S.A.F.; G. E. Tweddle, O.B.E., to the Air Ministry for duty in the Department of the C.A.S.

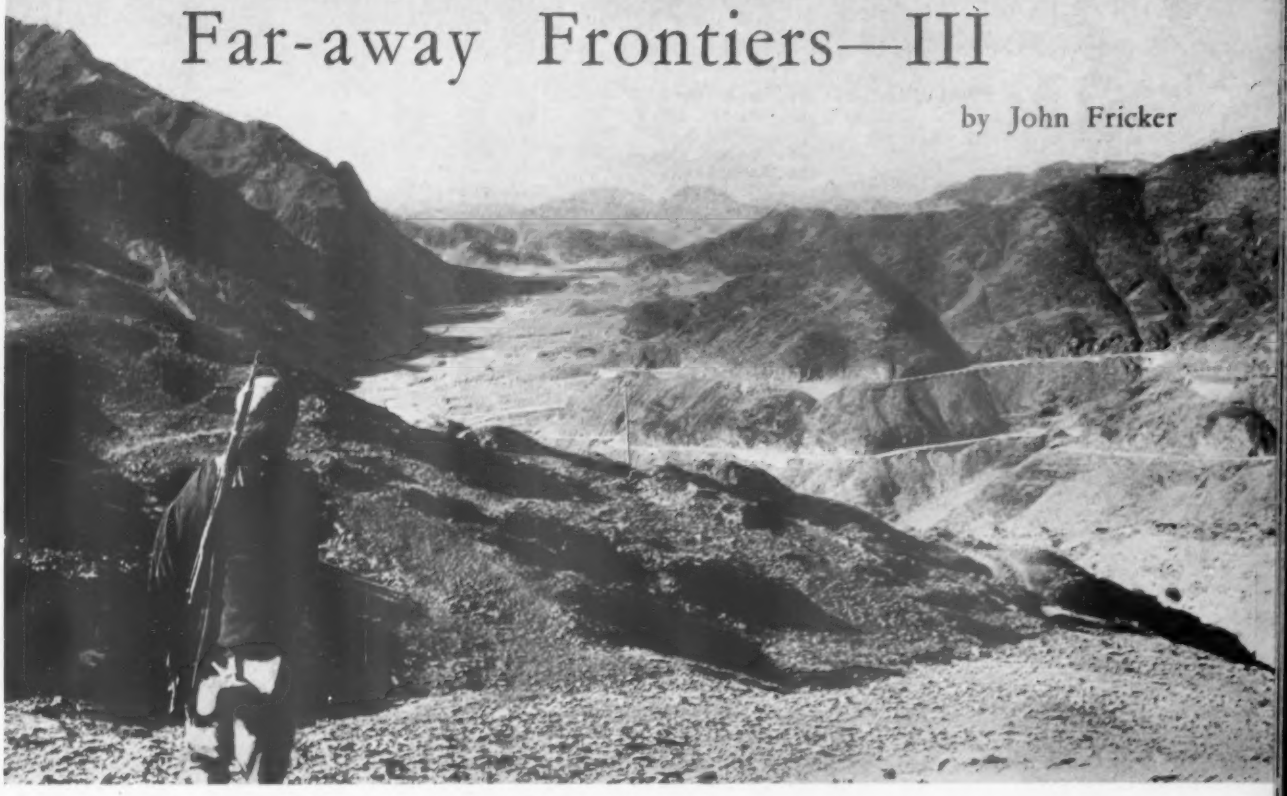
Reunion

No. 2 Group.—The 11th A.G.M. and reunion dinner of the Officers Association (Headquarters and units) will take place on May 3, 1958. Details from the secretary, 205 Eastgate, Louth, Lincs.

EMPIRE EQUIPMENT.—Above, are Australian-built Avon-Sabres of No. 3 Squadron being armed with 60-lb. practice rockets at R.A.A.F. Williamtown. Forming No. 78 (Fighter) Wing with Nos. 75 and 77 Squadrons, No. 3 is to become part of the Commonwealth Strategic Reserve in Malaya later this year. Left, the last of eight Avro Shackleton Mk. 3s for the South African Air Force at the manufacturers' airfield at Woodford before leaving for R.A.F. St. Eval and South Africa.

Far-away Frontiers—III

by John Fricker



In this concluding instalment of several articles on the Pakistan Air Force, the author describes Peshawar, the Khyber Pass, and a flight through the Western Himalayas to Kashmir. He also discusses jet training in Karachi.

FROM Risalpur to Peshawar by road is a brief but interesting journey alongside the broad and tranquil Kabul river, past fields of fruit and grain, and fertile pastures studded with the sprawling black tents of migrant nomads wintering from Afghanistan. An incongruous note is introduced by the increasing number of textile factories springing up by the roadside, but the industrial potential of Northern Pakistan is being greatly expanded by new schemes for hydro-electric power.

Peshawar, which is the main town of the North-Western area, and one of the principal cross-roads for Central Asia, through the adjacent Khyber Pass, has a most fascinating "native" quarter with the equally picturesque name of "the Bazaar of the Story-Tellers," in addition to a very large military cantonment. The Pakistan Air Force station there, commanded by Wg. Cdr. J. Afridi, is also the H.Q. of No. 1 (Operational) Group, under Air Cdre. M. Nur Khan, and its runways have been extended to accommodate the Sabres. Four squadrons of these aircraft moved in to Peshawar from Mauripur in mid-February, and will be based there for tactical operations.

The Sabres had not arrived, however, at the time of our visit, and except for some of the P.A.F.'s fighter-reconnaissance Lockheed RT-33s the large airfield contained only our faithful Wayfarer and one or two visiting aircraft. We were therefore able to devote slightly more time to the teeming and colourful streets of the Qissa Khawani bazaar, under the frowning old fort in this completely unspoilt area of the true East, and to drive along, if not to tread in the historic footsteps of Tamerlane and Alexander, Babur and Nadir Shah, towards the timeless Khyber itself.

The rambling Jamrud Fort marks the transition from the fertile fruit-growing plains of Peshawar to the rugged foothills of the mountains of Afghanistan, and soon the road begins to wind sinuously back and forth as it climbs through the barren cleft of the Khyber Pass. Perched precariously on the summits of the rocky crags are the windswept forts of the famous Khyber Rifles, whose patrols we began to encounter as we motored along the ancient caravan route, past mud-walled and fortified farms, which like everything in the area seem perpetually on guard.

The feats of the Royal Air Force, in their efforts to establish air control of this turbulent area in the late 'twenties, take on a new perspective when you see for yourself the forbidding grandeur and savage topography of the Khyber region, and imagine flying over it in ancient and fragile biplanes, with single overworked and overheated engines. Now the reverberations of Falcon, Eagle and Kestrel from the rocky and inhospitable walls have given place to the lonely cry of the kitehawk, just as the camel caravans of old have been superseded by the brightly coloured trucks and buses of the Kabul transport company. One of these vehicles had just been turned on to its side in a gully, off a perfectly straight road as we appeared, and the entire passenger complement was cheerfully engaged in endeavouring to right it. The Pathan belligerency may now be subdued, but never his sense of humour.

Our interim destination in the Khyber Pass was the fort at Lundi Kotal, where the R.A.F. had a landing strip many years ago, and where we now enjoyed the hospitality of the Khyber Rifles. It was our fate to arrive simultaneously with the Aga Khan, who was making a purely private visit to this part of the World, and we had the privilege of meeting this charming and unassuming young prince to complete a thoroughly memorable experience.

After lunch in the mess, and the departure of Prince Karim and his party, we continued our journey for the remaining few miles through the Khyber Pass to the North-West Frontier

Top, a characteristic view of the Khyber Pass, well known to several generations of R.A.F. pilots, and now patrolled by the Pakistan Air Force. Right, one of the narrow streets in the Bazaar of the Story-Tellers, Peshawar.

Photographs copyright "The Aeroplane"

itself, to the slim chain that marked the border between Pakistan and Afghanistan. As our Khyber Rifles escort swung out of their vehicle, the guard turned out smartly from the Pakistan frontier post. On the other side of the chain, white-robed Afghans dozed indolently in the warm sunshine, and the road to Kabul stretched straight ahead in the shadow of the hills, towards snow-capped mountains in the far distance.

Leaving the brooding mountains and pageantry of the Khyber, our last trip to distant frontiers on the following day was almost as memorable, and perhaps even more exciting. We had been scheduled to fly to Gilgit, in Northern Kashmir, earlier in our tour, but the weather conditions had been considered unfavourable, and so we made another attempt in the morning before our scheduled return to Karachi. As on our original date, the weather was cloudless, with a warm winter sun fairly low on the horizon, but the important difference was that it was forecast to remain stable, with little or no prospect of cloud.

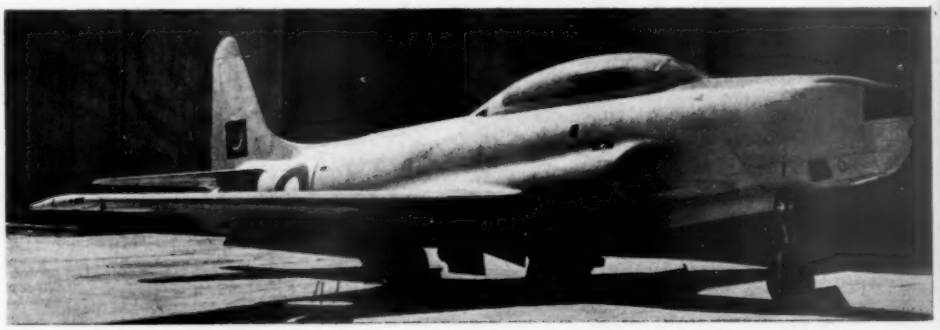
For sightseers like ourselves, cloudless conditions were essential, since the route flown is along the Indus, as it cleaves through the foothills of the Himalayas, with mountains rising vertically on each side at anything between 16,000 and 20,000 ft., and climbing at their highest point to the soaring summit of the 26,660-ft. Nanga Parbat. The Bristol 170s normally operate at about 10,000 ft., and although not usually stopped by cloud, their work, which is to supply the lonely mountain villages of N. Kashmir throughout the winter, is made doubly difficult in the narrow valleys.

This area has been entirely dependent on air supply, when the mule tracks are snowbound each winter, for the past 10 years, food and supplies being dropped by P.A.F. aircraft, with the assistance of Pakistan International Airlines. During that time, which included an incredible year of night operations when Indian Air Force fighters began to attack some of the transport aircraft, only one P.A.F. aircraft has been lost, through flying into a mountain side in cloud, in well over 500 sorties a year.

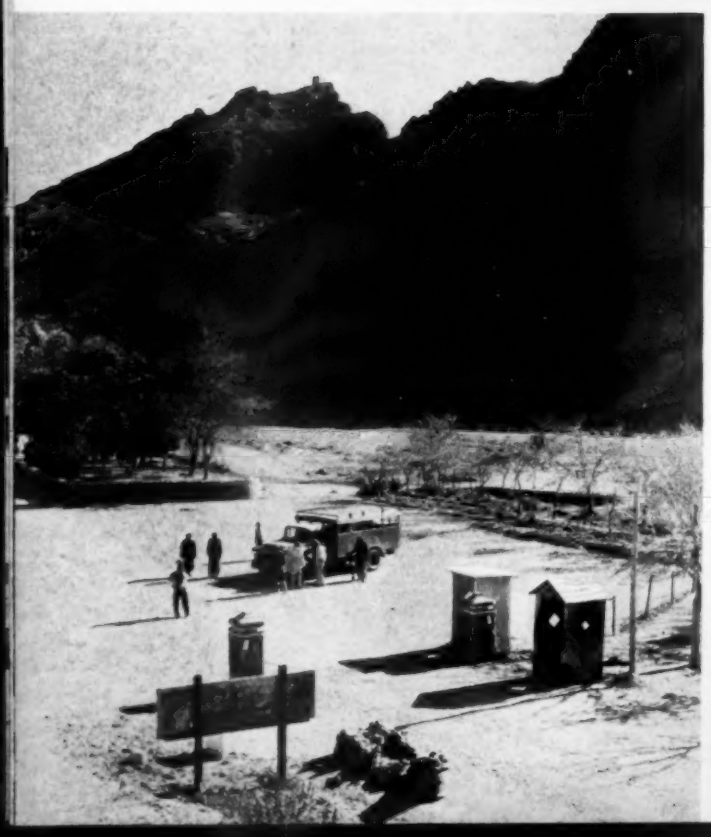
This was an encouraging thought as we picked up the Indus, after climbing out from Peshawar, and flew towards the narrowing walls of the winding river valley. A few snow-clad and pine-covered mountain tops whisked past our wing tips as we settled down at 11,000 ft. on the 2-hr. trip, but soon the summits towered above us, and the tapering walls of rock stretched on each side ahead, behind and below. Sometimes the mountains moved in until they seemed close enough to touch, and the sparkling, snow-covered branches of the pines looked like Christmas trees in an adjacent window. On occasions (but not often enough for at least one of the passengers) the valley widened sufficiently for a sandy floor to be seen far below, with the brown threads of the Indus winding to their source.

After a while, snow-covered peaks surrounded our insignificant little aircraft on all sides, and in the clear cold air they could be seen extending in range after range in serried majesty. Narrower valleys branched off from time to time from our winding course, and we swung briefly into one of these bottlenecks to have a slightly closer look at Nanga Parbat. We were fortunate in that the dazzlingly white summit was absolutely clear of orographic cloud, and the naked saddle of its peaks towered immediately above us. From the co-pilot's seat of the Wayfarer, the view was even more magnificent, and the impassiveness of our pilot, who on that occasion was Sqn. Ldr. Z. Butt, the O.C. of the P.A.F. Transport Examining Wing, was most reassuring.

Flg. Off. Sohail, who was acting as co-pilot on this trip, has spent several seasons with the "Valley Flight," operating from Chaklala and flying to the village dropping zones at Astor and Skardu. Supplies are dropped either from 500 ft.



A small number of Lockheed RT-33A reconnaissance fighters have been supplied to the Pakistan Air Force under the Mutual Aid programme, and are fitted with vertical, oblique or forward-facing cameras, and a wire-recorder for visual observation.



Left, looking into Pakistan from Afghanistan, with the border post in the foreground, and the Khyber Pass behind. Right, snow-covered pine trees seem dangerously close as the Bristol 170 enters the narrow Indus Valley on the flight to Gilgit, during which great reliance is placed on the sturdy Hercules 734.

Below, an unexpected and pleasurable encounter during a visit to the Khyber Rifles' mess at Lundi Kotal was with the young Aga Khan, seen here discussing photographic matters with the British Aeronautical Press.

Photographs copyright "The Aeroplane"

These photographs convey a little of the grandeur of the topography in Northern Kashmir, where the mountains rise to more than 26,000 ft., and the P.A.F. operates its Bristol Freighters at about 10,000 ft., in and out of the narrow valleys to drop supplies on such inhospitable areas as Astor (below), where the DZ is 7,500 ft. a.s.l. The pilot on this occasion was Sqn. Ldr. Z. Butt, P.A.F. (above). These operations were done for a period of a year, at night.

above DZ level by parachute, or from 300 ft. in free fall, towards suitable snowdrifts. On one occasion, the parachute from one of the underwing containers fouled the tailplane and jammed the elevator controls, but by brilliant flying, the pilot manœuvred the Freighter round the narrow valley and flew it back to Gilgit for a safe landing, despite the dead load of the pannier, the parachute drag and the restricted controls.

The early morning air was calm at our cruising altitude, but as we swung off into another narrow valley and began a gentle descent towards Astor, we began to meet the turbulence that is another hazard in this mountain flying. There seemed to be only just enough room for the Freighter, as we skimmed along the walls of rock, level with the precarious and winding mule tracks, but, towards Astor, which lies on a 7,500-ft. plateau, the mountains grudgingly opened out, allowing just enough room for a fairly steep turn. We ran straight in towards the DZ, which is on a sharply sloping shelf of rock, bumping and slithering around in the turbulent airflow from the wind sweeping over the terraced valley floor.

With the help of flap and the labour of Hercules we scraped round the edges of the mountain bowl and came in again low over the apparently isolated and snow-covered area, before completing another turn and climbing back towards the Indus valley. To reach Gilgit, it is then necessary to turn north into another valley, over a river tributary, and make a mountain-side approach on to the airstrip. This is nearly 5,000 ft. above sea level, but is still overlooked by towering ranges of peaks including the 25,500-ft. mass of Rakapushi. Gilgit is served by both the P.A.F. and Pakistan International Airlines, and is a popular winter resort, especially among Service personnel. Excellent ski-ing and, of course, climbing, are to be had, while among its other attractions is the local brand of polo, played on shaggy mountain ponies and with no holds barred. A match had been arranged for our benefit, but unfortunately we had to take off again almost immediately for the long return flight to Karachi.

The 4-hr. excursion through the so-called Black Mountains

Situated nearly 5,000 ft. above sea level is the airstrip at Gilgit, in Northern Kashmir, which is used by P.A.F. and P.I.A. aircraft

Photographs copyright "The Aeroplane"

gave us a very clear idea of the skill and determination of P.A.F. flying personnel, and the effort frequently required from them was well illustrated by the fact that our crew, after this trip from Peshawar to Gilgit and back, had then to fly us on the 4-hr. leg from Peshawar to Karachi; to return almost immediately to Chaklala, Rawalpindi, and then fly another V.I.P. passenger to Lahore. The last two legs would, of course, be at night, but, as it happened, the return trip was cancelled at the last moment.

It is fortunate that the Pakistanis seem to enjoy flying, and this impression was certainly confirmed by our last call of the tour, at the airfield of Mauripur, just outside Karachi. Mauripur, commanded by Gp. Capt. Sam Joseph, is one of the main jet bases of the P.A.F., and although several of the Sabre squadrons assembled there for the air display had dispersed (we saw some of them leaving, with long-range tanks, for Peshawar), Nos. 15, 16 and 17 Squadrons remained, together with Nos. 2 (Fighter Conversion) and 12 (Composite) Squadrons. A target-towing flight of Hawker Furies, fitted with M.L. winch units under the wings, is also resident at the moment, having moved from Drigh Road during its runway extension. The Furies tow banners for the Pakistan Navy and the P.A.F. Ground Combateers (the equivalent of the R.A.F. Regiment); the Sabre squadrons do their own target-towing.

No. 12 Squadron is an interesting unit with a variety of aircraft, containing as it does the President's Flight, comprising the V.I.P. Viscount, Viking, and Wayfarer, and a number of Bristol Freighters for various duties. This squadron used to operate about half a dozen Handley Page Halifaxes, mainly for maritime reconnaissance, and these have been replaced by four suitably equipped Bristol Freighters for visual reconnaissance and anti-submarine work. These aircraft have taken part in joint exercises in Ceylon, and have done quite well, and also operate extensively with the Pakistan Navy, to maintain suitable anti-submarine tactics and techniques.

Included in their duties is air/sea rescue, for which Lindholme gear and spare dinghies are carried, and one Freighter is always on stand-by at Mauripur, to fulfil the ICAO international commitment. The search and rescue Freighters will be replaced later this year by Grumman SA-16 amphibians, supplied to the P.A.F. under U.S. aid agreements, and based at Mauripur while some Pakistan personnel have been training in the United States on Sikorsky H-19 helicopters, for similar duties. Two of these rotorcraft have been presented to the President of Pakistan, and in all six will be received by the P.A.F. for search and rescue, one being based at each airfield where jet operations are in progress.

All Pakistan fighter pilots receive their jet conversion in No. 2 Squadron at Mauripur, under Sqn. Ldr. M. K. Abbasi, which is equipped with Lockheed T-33 jet trainers and half a dozen North American F-86F Sabre fighter-bombers. More than half of its students come direct from the "wings" course at Risalpur, while 8% come from piston-engined fighter or transport squadrons, 12% are staff pilots, and the remaining 25% of its commitments comprises instrument ratings for the jet squadron personnel.

Newly qualified students have completed 200-215 hr. on North American T-6Gs at Risalpur when they begin conversion to the T-33, and they fly 80 hr. in the first three months at Mauripur, as well as completing 125 hr. ground school. The second three months of the jet course includes two weeks at Korangi Creek studying the Sabre systems, before returning to Mauripur for 50 hr. flying on the F-86F, and a further 100 hr. ground school. The initial T-33 course includes air-to-air and air-to-ground gunnery, and the Shooting Star trainers are also used in the second phase to check progress and iron out particular problems.

During the Sabre conversion, the U.S.A.F. "chase-pilot" system is employed, with the instructor following the student in another aircraft and maintaining contact by R/T. The fifth exercise in the F-86 is a Mach run, taking the student supersonic for the first time, and is followed by formation, gunnery and tactical training. At the end of the conversion course, having completed 120 hr. flying and 300 hr. ground training in 24 weeks, graduating pilots are posted to fighter squadrons for continuation training, while others who fail to qualify are considered for duty with the transport squadrons.

Up to the time of our visit, 120 pupils in nine courses had passed through the jet conversion squadron, and 105 had qualified on Sabres, resulting in an overall wastage rate of 12½%. The jet aircraft were first received in May, 1956, the conversion squadron having previously operated Hawker Tempests and Furies, and since that time 8,000 hr. have been flown on the T-33s and 900 hr. on the F-86s of the unit. It says a great deal for the training techniques that in that time there has been only one fatal accident in the squadron, which was attributed to engine failure on take-off in a T-33, and six incidents involving trouble with nosewheels, drop tanks, etc., with the same type of aircraft.

The F-86s used for conversion have had no accidents or incidents, despite the fact that for four months they had to operate in very high temperatures from a 1,800-yd. runway with work in progress at each end. Except for two Q.F.I.s who trained at the C.F.S., the eight flying instructors on the unit were all trained in Pakistan, but have since been categorized by the R.A.F. Initially, a number of P.A.F. pilots did their jet conversion in Germany or the U.S., but all future training is being done at Mauripur. Every P.A.F. jet pilot, from the C.-in-C. downwards, is now instrument rated.

A gunnery school is to be established in Pakistan in April for developing fighter tactics but, in the meantime, intensive training is given on the squadrons. Visiting some of the units at Mauripur, we learned that 78 hr. flying on specific exercises is required from new pilots before they are considered operational, which takes about three-four months. Squadron establishment is similar to the R.A.F., and the training programme combines British and American ideas.

The standard of skill and proficiency shown by the fighter squadrons, as in all the other units visited, was most impressive, and there can be no question about the P.A.F.'s fighting efficiency, or the morale of its aircrew. In its watch over the remote frontiers of Central Asia, it is maintaining the fine traditions built up there by the R.A.F., and establishing a new, and highly individualistic pattern of its own.

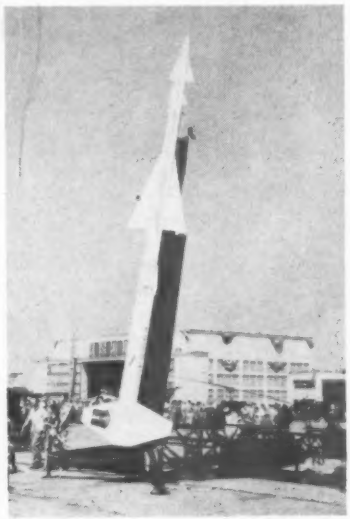
Main weapon of the Pakistan Air Force is the North American F-86F Sabre, on which pilots are trained at Mauripur, just outside Karachi.

THE AEROPLANE

GUIDED WEAPONS DATA SHEETS

More of our copyright series of guided missile data sheets are given on this and the following page. Previous sets have appeared in THE AEROPLANE for December 6, 1957, January 3 and February 14 last, when it was explained that the contents of the tables are based on published data from a number of sources and arranged in a standardized form. In this present set, as in the case of the previous tabulations, there are inevitably some gaps as a result of security restrictions or unreliability of published data. Further sets of these sheets, which have been compiled by MR. D. HOWE, D.C.Ae., A.M.I.Mech.E., A.F.R.Ae.S., will be published in THE AEROPLANE at regular intervals.

Throughout the tables the following abbreviations have been used:—A-A=air-to-air, A-S=air-to-surface, A-U=air-to-underwater, S-A=surface-to-air, S-S=surface-to-surface, S.R.=solid rocket, L.R.=liquid rocket, T.J.=turbojet, R.J.=ramjet.



NIKE AJAX (SAM-A-7) | S-A | U.S.A.

Design/Manufacture: *Western Electric/Douglas* | **Service:** *U.S. Army*

Guidance: *Command Link (Western Electric) (Martin Computer)*
Control: *Nose control and wing trailing edge.*
Warhead:

Main Power:
One L.R. THRUST: *2,600 lb.* DURATION: sec.
FUEL: *Gasoline.* OXIDANT: *Fuming Nitric Acid.*

Boost Power:
One Tandem S.R. THRUST: *lb. for* sec.

Weights:
MISSILE: *1,000 lb.* WEIGHT BOOSTED: *lb.* PAYLOAD: *lb.*

Dimensions:
LENGTH: *21.0 ft.** MAX. DIA.: *1.0 ft.* WING SPAN: *4.5 ft.*
FIN SPAN: *2.0 ft.*
BOOST LENGTH: *12.0 ft.* BOOST DIA.: *1.33 ft.* BOOST SPAN: *6.2 ft.*

Performance:
SPEED: *M=2.* HEIGHT: *65,000 ft.* RANGE: *35,000 yd. (slant).*

REMARKS:
Operational.

* 31.0 ft. with boost unit on.

TALOS (SAM-N-6) | S-A | U.S.A.

Design/Manufacture: *John Hopkins University/Bendix, McDonnell* | **Service:** *U.S. Navy. U.S.A.F.*

Guidance: *Beam Rider with semi-active homing.*
Control: *Moving wings.*
Warhead: *Nuclear or chemical H.E.*

Main Power:
One R.J. (McDonnell). THRUST: *lb.* DURATION: sec.
FUEL: . OXIDANT: — .

Boost Power:
One tandem S.R. THRUST: *lb. for* sec.

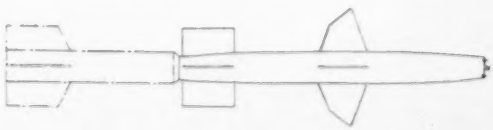
Weights:
MISSILE: *3,000 lb.* WEIGHT BOOSTED: *5,700 lb.* PAYLOAD: *lb.*

Dimensions:
LENGTH: *21.0 ft.** MAX. DIA.: *2.5 ft.** WING SPAN: *9.0 ft.**
FIN SPAN: *5.5 ft.**
BOOST LENGTH: *13.0 ft.** BOOST DIA.: *2.5 ft.** BOOST SPAN: *6.0 ft.**

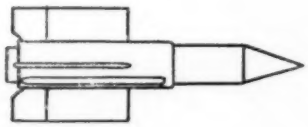
Performance:
SPEED: . HEIGHT: *60,000 ft.* RANGE: *75,000 yd. (slant).*

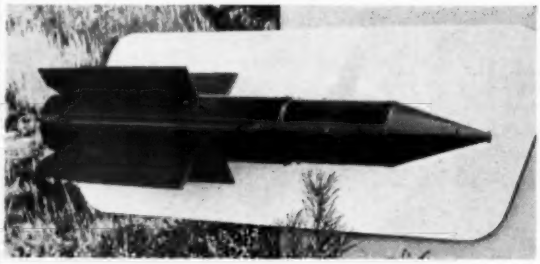
REMARKS:
Under development.

* Estimated.



THE AEROPLANE
GUIDED WEAPONS DATA SHEETS





TYPE 891 (Anti-tank) | S-S | GREAT BRITAIN

Design/manufacture
Vickers-Armstrongs/Vickers-Armstrongs

Service

Guidance: *Wire.*
Control: *Wing trailing edge.*
Warhead: *Hollow charge, impact fuse.*

Main Power:
One S.R. THRUST: *lb.* DURATION: *sec.*
FUEL: OXIDANT: —

Boost Power:
None THRUST: — *lb. for* — *sec.*

Weights:
MISSILE: *40 lb.** WEIGHT BOOSTED: — *lb.* PAYLOAD: *lb.*

Dimensions:
LENGTH: *2.7 ft.* MAX. DIA.: *0.38 ft.* WING SPAN: *0.92 ft.*
FIN SPAN: — *ft.*
BOOST LENGTH: — *ft.* BOOST DIA.: — *ft.* BOOST SPAN: — *ft.*

Performance:
SPEED: *Subsonic.* HEIGHT: *ft.* RANGE:

REMARKS:

* Includes launcher and control gear.

DART (SSM-A-23) | S-S | U.S.A.

Design/manufacture
Aerophysics Dev. Corp./Utica-Bend

Service
U.S. Army

Guidance: *Wire (Wagner optical system).*
Control: *Wing trailing edge.*
Warhead: *Hollow charge.*

Main Power:
One S.R. THRUST: *lb.* DURATION: *sec.*
FUEL: *Grand Central.* OXIDANT: — .

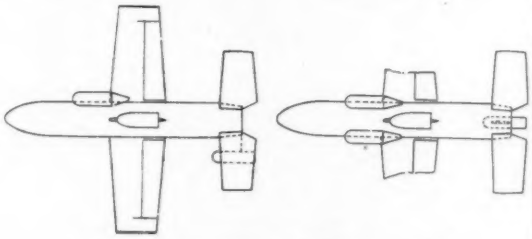
Boost Power:
None. THRUST: — *lb. for* — *sec.*

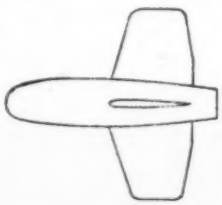
Weights:
MISSILE: *300 lb.* WEIGHT BOOSTED: — *lb.* PAYLOAD: *lb.*

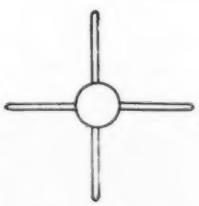
Dimensions:
LENGTH: *5.0 ft.* MAX. DIA.: *0.75 ft.* WING SPAN: *4.5 ft.*
FIN SPAN: *ft.*
BOOST LENGTH: — *ft.* BOOST DIA.: — *ft.* BOOST SPAN: — *ft.*

Performance:
SPEED: *M=0.8.* HEIGHT: *ft.* RANGE: *3 miles.*

REMARKS:
Anti-tank weapon. Launched from M59 personnel truck. Tracked by sodium flares in tail fairing. Production.







S.N.C.A.N. 5200 (S.S. 10) | S-S | FRANCE

Design/manufacture
S.F.E.C.M.A.S.–S.N.C.A.N./S.N.C.A.N.

Service
French Army

Guidance: *Wire.*
Control: *Wing trailing edge. Spin stabilized.*
Warhead: *Hollow charge (armour piercing), impact fuse.*

Main Power:
Two-stage S.R. THRUST: *lb.* DURATION: *sec.*
FUEL: OXIDANT: —

Boost Power:
None. THRUST: — *lb. for* — *sec.*

Weights:
MISSILE: *34 lb.* WEIGHT BOOSTED: — *lb.* PAYLOAD: *6.7 lb.*

Dimensions:
LENGTH: *2.8 ft.* MAX. DIA.: *0.6 ft.* WING SPAN: *2.5 ft.*
FIN SPAN: — *ft.*
BOOST LENGTH: — *ft.* BOOST DIA.: — *ft.* BOOST SPAN: — *ft.*

Performance:
SPEED: *Subsonic**. HEIGHT: *ft.* RANGE: *1,800 yd.*

REMARKS:
Anti-tank weapon. Has been launched from helicopters. Operational. Entac is identical.

* M=0.25 approx.

From the Lecture Room

Australia's Weapons Research Range

A STORY of achievement was reported to the Guided Flight Section of the Royal Aeronautical Society in a paper "Guided Flight Trials" on February 25. Mr. R. W. M. Boswell, O.B.E., M.Sc., had come to describe the work of the Weapons Research Establishment in running Woomera, now the finest range in the World. He is now Deputy Controller responsible for Trials and Instrumentation at the Weapons Research Establishment.

Mr. Boswell said he had deeply considered the philosophy and the main characteristics of trials, and the leading characteristic at every stage was extreme expense! For a trial, a hundred men were deployed over half a million acres of land, and another hundred men were needed in support. During the flight, which might last some minutes, 5,000 feet of film were exposed, and 2,000 feet of tape; the major costs were in the preparations before the trial and in the analysis of the results after the flight.

Organization

The Trials Wing of the Weapons Research Establishment was organized in four divisions. In the Trials Division, the Missile Projects Group received a statement of the problem from the contractor, planned the method of solving the problem, and prepared the Trials Instruction which laid down the facilities and measurements required of the range.

The Ranges Group of the Trials Division (at Woomera) did the trial, with the help of the R.A.A.F. if necessary, and the results were dealt with by the Mathematical Services Group.

The Range Development Division was responsible for all instrumentation at Woomera; it might procure from the U.K. or elsewhere or might itself develop the systems which were needed. It was supported by a Techniques Division which might, for example, work on improving the design of a lens or of an aerial; work which, in the U.K., might be done at a University or in the research department of a contractor. Lastly, there was the Systems Assessment Division which was not concerned with development trials; in conjunction with the R.A.E., it designed and did the Acceptance Trials of new weapons.

Air support was provided by the Royal Australian Air Force. Army personnel operated radar and handled explosives.

The establishment and maintenance of the range head was unavoidably expensive; owing to its isolation and the need for reasonable amenities it cost two and a half times as much to maintain a man there as in a capital city. So the Wing was based at Salisbury near Adelaide where buildings of 1½ million square feet floor space were available; and only a quarter of the Wing, a total of some 3,000 souls including women and children, were at Woomera. The difficulties of separation, by 300 miles, were reduced by direct teletype and telephone lines, a daily air service, and road and rail connections.

The weather at Woomera was good and usually clear; bad weather caused less than 10% of scheduled trials to be delayed. Optical instruments with their high resolving power could be used. The range length to the coast was 1,250 miles over practically unpopulated land, and this could be extended for another 2,000 miles over the Indian Ocean, with the Cocos and Christmas Islands near the middle of this extension.

In a film shown by the lecturer, the take-off of a Jindivik was seen on a wheeled trolley from which it disengaged as it rose, and then the landing of a Jindivik on its skid. Next the launch of a Fireflash from the wing of an aircraft was seen; it followed and struck a target drone; and then a warhead round destroyed a drone; and a Thunderbird destroyed yet another drone.

But the most impressive sequence was the last, of the Australian missile Malkara. A flag was held up on posts to represent the target tank, and the flag had a large central hole as a "bull's-eye." The film camera was set on the ground looking up through this hole through which the approaching missile could be seen. Eventually it swept down and came straight through the hole!

Instruments and Targets

Dealing first with the optical systems, the Contraves ciné theodolite now used is operated by two observers (Fig. 1) and will work to 12 or 14 seconds of arc if carefully levelled. The film exposure rate is 40 per sec., and the shutter locked by synchronous motor to the central timing system. The servo system can be slaved to a nearby radar for putting on, or can be slaved to a more distant radar through a parallax computer if necessary. A number of successful observers have been found among the housewives at Woomera and two are shown in the illustration.

The Vinten camera, using 35-mm. film, was used with various lenses with focal lengths up to 80 in. which gave a field of .5 × .75 degrees. Shutter speeds allowed up to 300 exposures per sec. although limited to 60 with the 80-in. lens, the aperture of which was only f11. When a camera with a higher exposure rate was needed, a Fastax could be used with a maximum rate of 2,000 per sec. using a lens of shorter focal length and larger aperture. For bombing trials a special ballistic camera giving multiple exposures on a fixed film was used with exposures timed to one millisecond, and able to fix the position of an aircraft at 60,000 ft. within 1 ft.

Cameras were mounted on the wingtips of drones to measure miss distance; as the missile might approach from any angle, complete spherical coverage was needed, and this previously took four cameras in each pod. To reduce the weight and drag of the pod which affected the performance of the Jindivik, a new lens (Fig. 2) had been successfully developed which gave a field of view of 210° (Fig. 3) so that two cameras would give the spherical coverage. The pod could then be reduced to 5½ in. in diameter and 30 lb. in weight from 10½ in. and 80 lb. The new pod is shown in Fig. 4.

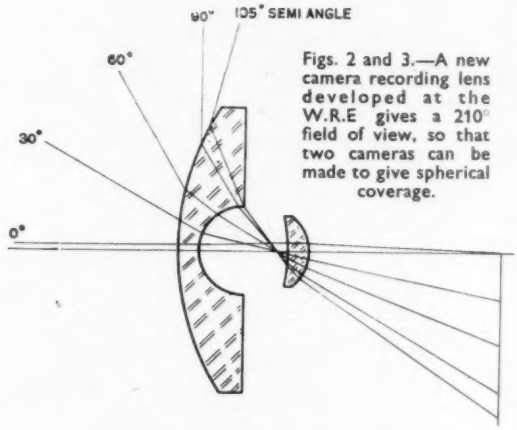
For information of the internals of the missile, an SRDE/RAE frequency modulated time multiplexed telemeter was used giving normally 16 channels of information and 24 channels in all. This had been modified to insert one or two continuous channels in part of the spectrum still available and these channels were used with barium titanate vibration transducers giving information of vibration occurring in flight.

A four-channel and also a single-channel scratch recorder had been developed at W.R.E. for rounds which were to be recovered.

For target drones, converted Meteors and Jindiviks were used at present. The Meteor had the advantage that it could be flown by a pilot in development trials and rehearsals. The Jindivik, being smaller, could be turned round more quickly and needed less servicing effort. A telemeter had been fitted to a Jindivik to explore its manœuvrability and performance. This would probably become a standard fitting as it led to improved results and was more economical than adding complications to the auto-pilot.

By rigorous pre-flight preparation, the

Fig. 1.—Contraves ciné theodolites in operation at Woomera; these will work to 12 or 14 seconds of arc.



Figs. 2 and 3.—A new camera recording lens developed at the W.R.E gives a 210° field of view, so that two cameras can be made to give spherical coverage.

accident rate had been brought to the figure of 1 in 16 flights in 1957 against an originally planned 1 in 5. In fact, the original expectation of having a rather cheap target with a high loss rate had become a good and carefully prepared device with a much better yield of useful flights per aircraft.

It was now hoped to increase the operational ceiling of the Jindivik to 60,000 ft. by increasing the wing span by 6 ft., fitting the improved camera pods, and installing the higher powered Viper ASV.11 engine.

To track target, and other aircraft in the range area, radar and MTS were used. A transponder might be used in the aircraft, with the radar. MTS was a continuous transmitter in the aircraft which was followed by direction-finding receiving stations.

For determining the trajectory of a missile, Doppler was used, and again a transponder, re-radiating at double frequency, was sometimes used if there was room in the missile.

Automatic Data Reduction

A centralized data reduction system for all customers was provided at W.R.E.; contractors did not have computing staffs in Australia.

When this problem was assessed some five years ago, it was apparent that the computing staff would have to be increased some six times if the same methods were continued. At that time nearly all data were recorded on photographic film, an expensive material needing processing which had to be read by eye. About 70% of computing staff time was spent in getting the figures from the records, and 90% of the data points came from telemeter or Doppler, in the form of frequency variation. The decision was taken to put this information in a form, such as magnetic tape, which could be fed quickly into a fast computer.

While this system was being developed, labour-saving devices such as semi-automatic film readers were installed with keyboards to record readings on punched cards; and these cards were fed into automatic plotting machines or tabulators. This allowed the staff to cope with three times the previous work load.

The fully automatic system was finished and successfully installed two years ago. It produced graphic or tabular displays of either corrected results or of analysed results from raw data recorded on magnetic tape; film readers were more economical and were still used for optical records such as ciné theodolite film.

The system was to record the frequency of the telemeter (or Doppler) record on one magnetic tape together with a timing wave of constant frequency. The tape was replayed in the converter where an electronic gate opened for the duration of a fixed number of data cycles and the number of cycles of the reference frequency in this duration was counted; the gate duration was chosen to give a count of at least 400 cycles which gave a reading accuracy of one-quarter per cent.

The counts were converted into binary numbers, and these were serially recorded on a second magnetic tape for insertion in the digital computer. True elapsed time was also recorded at intervals on the second tape so that interesting parts of the record could be selected for detailed analysis, and records from other instruments could be synchronized.

Doppler records, which were continuous, were measured in the same way but two counters were used, one counting while the other was scanned and then interchanged in a time much shorter than the smallest unit of measurement.

The digital computer WREDAC accepted either magnetic or paper tape inputs. The secondary tapes from the telemeter and Doppler converters were fed in with a paper tape carrying instructions and calibration data. The corrected data on the time scale desired were fed out on a tertiary magnetic tape for further computation or display. The tabular display consisted of an elapsed time followed by the values for each of 16 channels each given to three decimal digits, which matches the converter accuracy, and this was printed at three lines a second which was fast enough for the present.

Running in parallel with the tabulator were four Mufax printers each plotting four of the tabulated channels. Scale markings were simultaneously written as Mufax was a "wet" process.

The output of the semi-automatic film readers was on punched paper tape and this could also be fed into WREDAC.

The total effect of this system had been to increase the working capacity of the computing staff by 20 times, the composition of the staff had also changed, for 20% were now technicians or engineers rather than mathematicians or computers.

The first step of introducing semi-automatic readers with Hollerith cards reduced the working time by half; the introduction of the computer, retaining punched cards, reduced this again by half, the time for processing 10,000 points being 20 hours. The final adoption of magnetic tape and automatic reading gave a processing time for 10,000 points of 35 min.

Recovery After Firing

At Woomera, 99% of the missiles fired had been recovered; so far the object had been to aid investigations, for it was often possible to find material failures by inspection or by laboratory investigation. If an aid to recovery, such as a parachute,

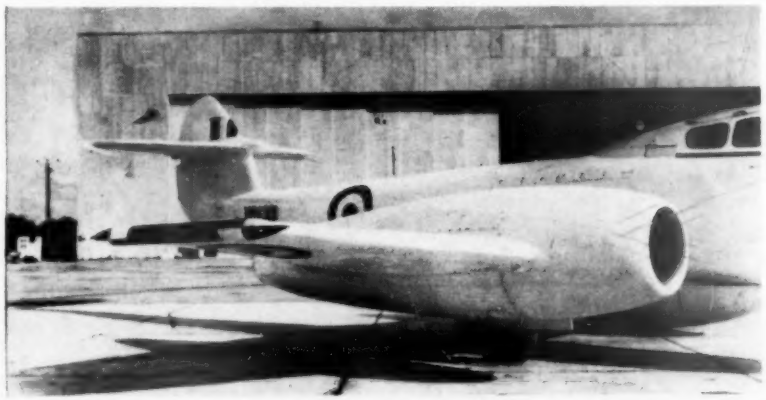


Fig. 4.—A Meteor with the new W.R.E. pod to take a pair of cameras giving a spherical coverage.

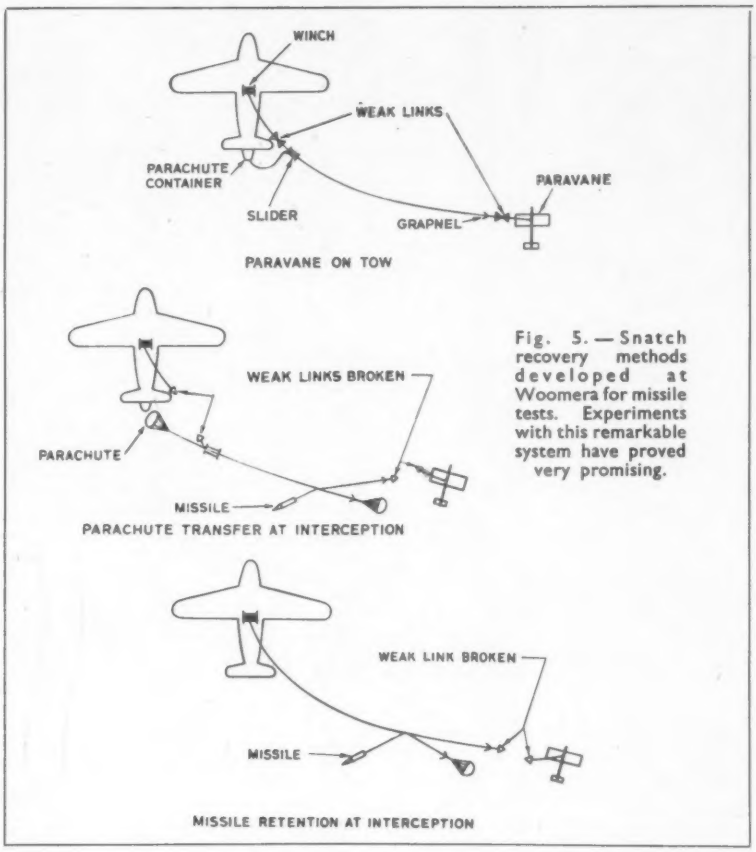


Fig. 5.—Snatch recovery methods developed at Woomera for missile tests. Experiments with this remarkable system have proved very promising.

could be fitted, recoverable test recordings, scratch records, tape records, or temperature indicating paints could be used. Methods of recovering missiles were now being developed to allow the economy of re-use.

Originally, missiles had been allowed to follow a normal trajectory and hit the ground at high velocity; as the speed was 600 ft./sec. or more, heavy damage or destruction occurred and it was difficult to determine the cause of a failure in flight. Missiles were sometimes lost, sections had been found at depths of more than 20 ft.

To break up the round, they now fitted to it a circumferential charge in a specially machined rig. This made a controlled cut, with very little damage, in the exact position to produce unstable sections which tumbled as they fell, giving the maximum drag and corresponding reduction of the impact velocity. More information of failures in flight could then be found. Also many of the more robust components could be used again.

If there were enough space to spare in a convenient part of the missile, a parachute could be used. A small parachute giving an impact velocity of 50 or even 100 ft./sec. could be used if the object were to examine internal components and recover scratch recorders, or cameras. Or a small drogue to reduce the speed initially from 1,000 ft./sec. to 400 ft./sec. could be used followed by a larger main parachute; and this allowed control fin actuators and the telemeter to be recovered for another flight.

In the Bristol project Bobbin, air brakes, then high-speed drogues, and finally a large parachute, were all used in turn to give a final impact velocity of about 25 ft./sec. and the missile was undamaged and could be used again. Though such systems could show great savings, both in the cost of the missile and in the preparation time, the right space for the gear had to be provided in the design of the missile.

The most advanced method of recovery would be to retrieve the missile before it reached the Earth. A scheme to achieve this had been proposed by H. C. Pritchard, it was modified by S. B. Jackson, and largely developed by W. T. S. Pearson. See Fig. 5.

In this scheme the missile carried a small parachute on a cable of 100 ft., which reduced the speed of fall to about 200 ft./sec.

An aircraft was marshalled so that it would be able to intercept the falling missile at a height of about 5,000 ft. The aircraft was fitted with an optical sight to assist the final stage of the interception. It towed a cable which was held out sideways by a paravane. In front of the paravane there was a grapnel.

The aircraft was flown past the falling missile so that its own cable crossed the missile cable and was dragged over it until the grapnels engaged when the missile parachute and the paravane were jettisoned by the impact.

The aircraft cable was on a constant friction winch, of the type used for the snatch pick-up of gliders, which paid out at constant tension while the missile was accelerated to the aircraft speed. The cable was then wound in until the missile cable reached the aircraft. Then the missile cable end was attached to the aircraft by a weak link leaving the missile trailing on its cable ready for the next stage.

The ground rig was a cable system stretched across a gully. The pilot flew across this so low that the missile cable hit the gully cable and slid over it until a grapnel fixed to the missile engaged with the gully cable and then the weak link holding the missile cable to the aircraft broke. The ends of the gully cable had shock absorbers.

While his hearers might think that this was a little far fetched, Mr. Boswell said that two of the last three trials of picking up a falling missile had succeeded. A dummy missile towed off the aerodrome had been transferred to the gully rig. They still had to check the process of reeling in the cable and carrying the missile after pick-up.

The process of marshalling the aircraft into position for the interception seemed to need improvement; they hoped to get a suitable aircraft, a modified Dakota, for trials in the next few weeks when the whole system could be tried and its possibilities explored.

In concluding, Mr. Boswell spoke generously of the work of his predecessors in his post, Dr. C. F. Bareford, Mr. H. C. Pritchard and Mr. R. W. Pye.

Discussion

MR. W. H. STEPHENS (R.A.E.), opening the discussion, asked how heavy a missile did they hope to be able to recover by the scheme described; he also asked whether the form of instrumentation used and the system of data reduction could be used in trials of ballistic missiles. Mr. Boswell said that they hoped to be able to recover missiles weighing up to 1,000 lb. but not with the Dakota. He thought that the fundamental basis of the data reduction system made it suitable for use with ballistic missiles; but they would also retain the optical systems, for experience at Patrick seemed to show that interesting events might occur soon after the launch.

He was asked what observations had been made on the Russian satellite, and he said that it had been seen with binoculars and had been tracked with the Contraves ciné theodolite and also with accuracy by a surveyor with his own instruments. The orbit had been calculated approximately.

They had also observed the 40 megacycle transmissions which were useful to them for atmospheric measurements. They had been provided with a "Minitrack" with which they had observed Explorer and had sent the raw measurements to the Control centre in U.S.A. and also to the Smithsonian Institute.

MR. M. NEEDHAM (Bristol Aero Engines) said that with the increase of the quantity of data wanted from each flight and the increase of range, there was a need for a corresponding increase of internal recording systems and for recovery, particularly as instruments tended to be concentrated near the firing point to cover the launching phase.

MR. J. E. SERBY (M.o.S.) said that he fully supported Mr. Boswell in the need for economical operation of trials and in all phases of guided weapon development. He said that he enjoyed collaborating with the Weapons Research Establishment and was proud of his connection with such helpful and able colleagues.

DR. G. W. H. GARDNER (Director, R.A.E.) in winding up the lecture, said that he fully supported what had been said by Mr. Serby; he was glad to see that Dr. Bareford and Mr. Pye were present in the audience. Earlier he had recalled being one of a party who, in 1947, had stuck pegs into the desert to mark positions on the future range.

—KENTIGERN.

From a Paris Lecture Hall

"The Future of Aeronautical Research" was the title of the 11th Louis Blériot Lecture, read in Paris on March 5 by W. J. DUNCAN, C.B.E., D.Sc., M.I.Mech.E., F.R.Ae.S., F.R.S., *Professor of Aeronautics and Fluid Mechanics at Glasgow University. Some points from his lecture, which listed future trends of research and referred to the education and training needed for research workers, are given below.*

● RESEARCH EXTRAVAGANCE. Aeronautical activities are still carried on in an atmosphere of extravagance. This had its origin when success in war depended crucially on an adequate supply of efficient aeroplanes and almost no price was too high to pay for this.

Even on the civil side a similar atmosphere exists, partly because the public has been ready to pay extravagantly for the advantages of aerial transport and partly because national prestige has demanded a prominent place. This has usually carried with it the provision of open or hidden subsidies.

In the future aeronautics must be conducted more economically, and economy will become an ever more important aim of research, conclusions implying a great deal of hard and clear thinking by aeronautical engineers and administrators.

● NOISE. An important research aim in the future will be the elimination of aeronautical nuisances of all kinds; noise is the worst.

● AIMS. The general aims of research can be listed as: (a) improved understanding of phenomena; (b) improved means and methods of experiment, calculation and design; (c) improved performance, in the most general sense of the word; (d) financial economy; (e) safety; (f) freedom from nuisance; (g) dissemination of knowledge.

● FLOW SEPARATION. In the past it has been taken for granted that any separation of flow is a bad thing. However, quite recently it has been recognized that in certain circumstances breakaway of flow may be advantageous and result in an increased ratio of lift to drag. The potentiality for the useful exploitation of separated flow appears to be greatest for very thin wings in high-speed flight. We may anticipate fruitful researches on this topic.

● FATIGUE AND HEATING. In recent years there has been a growing appreciation of the outstanding importance of fatigue in relation to aircraft structures of all kinds. A new topic of great significance is the influence of kinetic heating on the strength and life of structures. The two come together in the problems of fatigue and creep at elevated temperatures.

Little is yet known with certainty about the fundamental physics of the fatigue of metals, but there is a world-wide interest in the subject and substantial progress may be honed for. There is a widening appreciation that the strength-fatigue-creep complex is a single subject which can only be understood and mastered through the avenue of the fundamental physics of metals.

An essential in the development of an aircraft structure is the full-scale testing programme which includes static tests to failure and thorough fatigue tests, at least on specially vulnerable parts. Statistics of such tests show that premature failures of the structure as originally designed are the rule, not the exception. Thus there is an evident need for more intelligent and scientific design.

● PROPULSION. Broadly speaking, progress in aircraft propulsion has depended very much on ideas and inventions which have been guided by sound scientific knowledge but quantitative theory has played a very small part.

The standard pattern of development of a propulsive unit includes a prodigiously prolonged series of tests on bench and in flight. This may have been necessary but it is suspected that the comforting knowledge that everything will be tested exhaustively before the article is put into production has had an unfortunately inhibiting effect on intelligent thought.

The present development programme of a propulsive unit is extravagant. The makers of aircraft engines must attempt to replace a part of the present unduly lengthy testing by more intelligence in the initial designing.

● CALCULATION TECHNIQUES. The calculations made in the design of an aircraft are vastly more numerous and more complex than they were in the past and this tendency will doubtless continue. Research on the design and methods of application of computers to solve these problems will be of great importance but there is still great scope for the improvement of mathematical techniques in aeronautics. Numerous problems have been made simpler (and, incidentally, suitable for immediate solution by machine) by the application of the mathematical technique of, for example, matrices.

Equally valuable and fundamental advances will doubtless be made in the future.

● KNOWLEDGE CIRCULATION. The output of scientific and technical papers is so enormous that research workers are in danger of smothering themselves beneath their own products. The problem is to ensure the positive international dissemination of all new knowledge and to protect the individual against matter that is trivial or merely repetitive.

Well-written and reliable textbooks and monographs, the most effective means for disseminating systematized knowledge, are advisable, even if they can never be quite up-to-date. It may soon be more valuable to publish a lucid and accurate account of a subject than to make new discoveries, except those of a fundamental nature.

● RESEARCH QUALITIES. I suggest that the qualities of a good research worker are honesty; observation and alertness; imagination and openmindedness; critical faculty, especially self-criticism; logical reasoning; clear expression in writing and speech; adequate knowledge and especially knowledge of fundamentals; interest in the subject, with energy and dogged determination.

● EDUCATION. I believe that the teaching in the later years of schooling, say from the age of 14 onwards, is of paramount importance in training research workers. During this period the boy or girl normally acquires an enthusiasm for some subject or subjects which may last throughout life. An aim of the very first importance is the acquirement of mastery of the mother tongue. The future researcher must learn clear thinking, best acquired by constant exercise in writing and speaking.

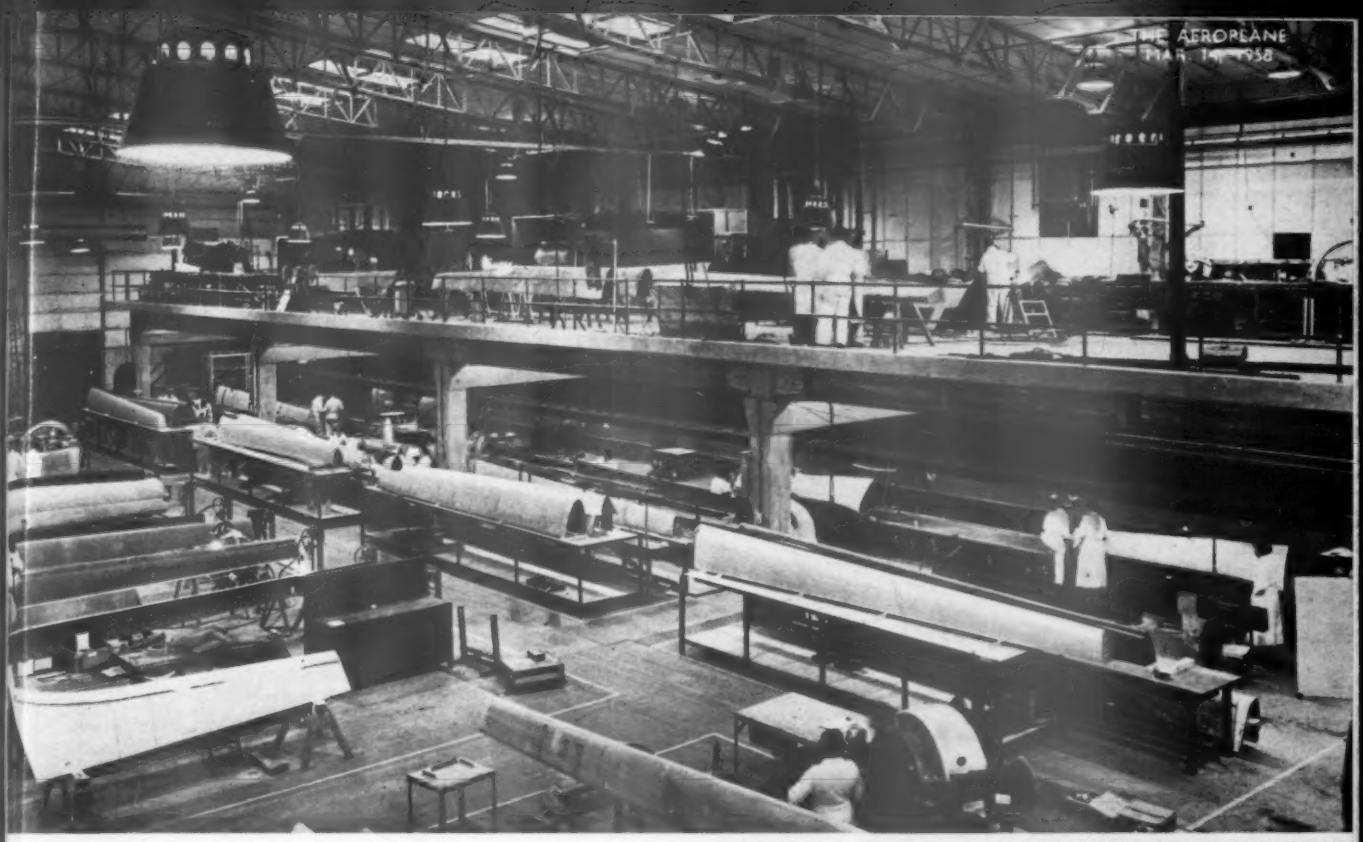
Since mathematics plays a part of always-increasing importance in all the sciences there should be ample high-quality mathematical instruction. An adequate programme of laboratory work is essential, while some experience in workshops is most desirable; the history of science (the most interesting and inspiring part of history) should be included.

In the teaching of research workers at universities emphasis should be placed on fundamentals. The thorough acquirement of fundamentals is very difficult and takes a long time, except for the most highly gifted; 99% of students acquire no new fundamental knowledge after leaving the university. Non-fundamental techniques and knowledge are easily learnt when the learner has a good grasp of fundamentals.

● RESEARCH SUPPLY. In research workers quality is of much greater importance than quantity, although the quantitative aspect cannot be neglected. If you want an adequate supply of able researchers you must provide the proper conditions at school and during higher education. Research workers should be backed up by adequate teams of technicians and mechanics.

There must be a proper balance between theory, experiment and practice. Long ago Boltzmann said, "Nothing is so practical as a really good theory," and still longer ago Francis Bacon said, "Truth emerges more quickly from error than from confusion." The last saying serves to emphasize that a theory may be very useful at some stage of an inquiry even when it is incorrect or inadequate.

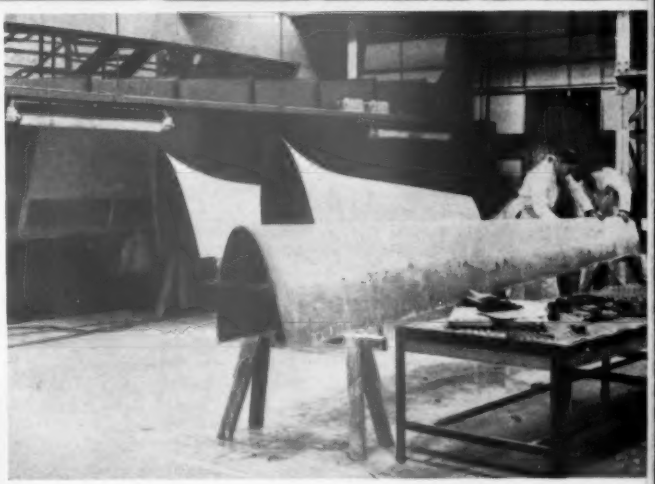
● DUPLICATION. We need real efficiency rather than narrow financial economy in aeronautical research. Apparent economy can be attained by the strict application of the principle of "no duplication of effort"; but the complete avoidance of duplication is not desirable. Different investigators or teams studying the same problem see differing aspects of the truth. Progress is most sure and rapid when there are simultaneous and independent attacks on the same problem and it is really necessary for any country with an important aeronautical industry to have teams working on all important research topics, otherwise there will be a failure to obtain that knowledge of and close feeling for the subject which can only be got by participation in research. Some duplication is thus actually desirable while extravagant duplication is to be avoided.

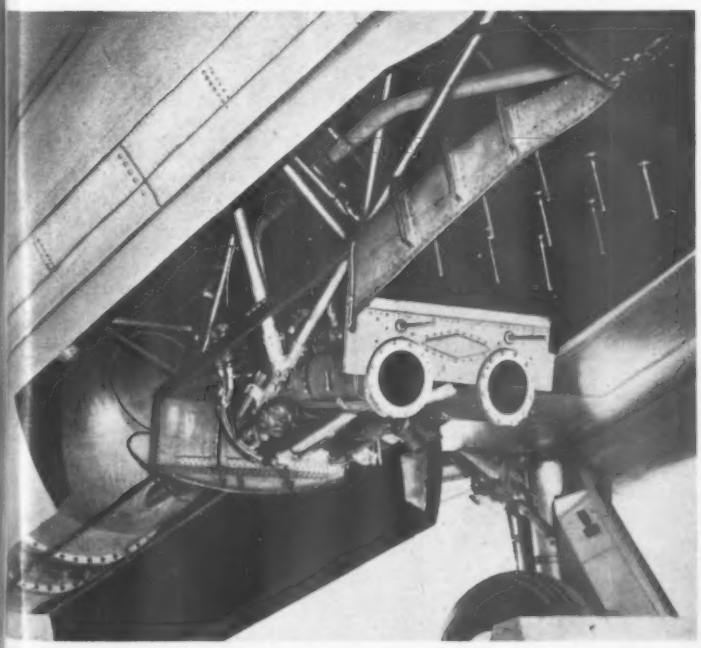


Activities at Luton

A wide variety of work is done by the Napier Flight Development Establishment at Luton—as these photographs show. Above, a general view of the newly re-organized production shop for Spraymat de-icing equipment; on the right is the associated paint spray-booth.

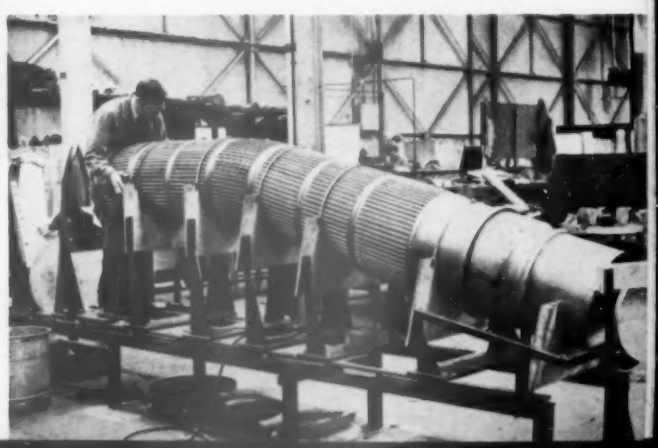
Photographs copyright "The Aeroplane"





Left, a new photograph of the Napier Double-Scorpion installed in a Canberra; a combination of this type holds the World's height record and the Double-Scorpion has been selected as a rocket power-pack for the P. 1B. Below, a jet tailpipe for the second Eland-Convair, the powerplants for which are now being built at Luton.

Photograph copyright "The Aeroplane"



NEWS OF INDUSTRY

Aircraft Air Ducting

A CLOSE examination of any high-performance aircraft, and in particular those powered by gas turbines, will reveal large quantities of tubing, both rigid and flexible, for conveying fuels, hydraulic oil, electrical wiring, air and other services. Such tubing or ducting systems employ a wide variety of types capable of withstanding up to 4,000-p.s.i. internal working pressures coupled with ambient temperatures which may vary between 200° C. down to −60° C.

Air-ducting layouts, in particular those for low-pressure systems, may vary in diameter from ½-in. to 7-in. bore and above, for conveying and distributing air within the aircraft. Wherever possible and practicable such ducts are constructed of rigid light-alloy tubing, but where space is limited and intricate shapes are necessary a highly flexible thin-walled tubing, capable of being formed on minimum-bend radius without collapse of the cross-section, is required. Such a tubing is "Flexflyte," which is now widely used on both civil and military aircraft.

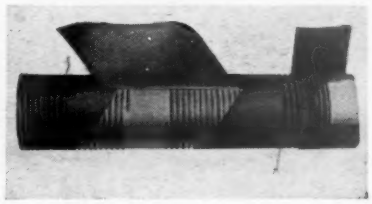
Flexflyte, illustrated on this page, is built around a helically wound high-tensile steel wire; is galvanized to resist corrosion and varies in gauge and also in pitch over the size range. This helical-wire reinforcement, correctly supported and positioned in the body of the tube, provides the hoop strength to resist inadvertent damage caused by man-handling.

Normally constructed of synthetic rubber-coated Fibreglass, the inner liner and outer cover constitute the pressure-carrying element of the tube and are integrally bonded by synthetic rubber impregnation to the wire helix, assisted by a Fibreglass cord positioned externally between the individual turns of the wire helix. Where a very low pressure only is called for, the inner liner is omitted entirely in one case; and where improved pressure resistance and lowered permeability factor are required, the inner liner is replaced by a synthetic rubber sheet stock liner.

End cuffs, normally factory-attached, form an integral part of the assembly and provide the means by which Flexflyte is attached to the mating components or tubing, which is beaded in accordance with standard practice for attachment by worm-drive clipping or some such approved means. The Fibreglass of the cuffs is fitted on the bias to ensure the easy expansion of the cuff over the tube head to which it is attached.

At the time of writing there are four standard types of Flexflyte. Three of these have an equal temperature range (−65° F. to + 350° F.) but vary in their ability to handle pressure and in permeability; while the fourth type is specially designed for higher temperatures (−120° F. to +650° F.). Type U-1 has the lowest pressure rating, is lightest in weight, and has no inner liner, only the reinforcing helix and a neoprene-coated Fibreglass outer cover; Type L-1 is the medium-pressure Flexflyte with both inner liner and outer cover of neoprene-coated Fibreglass fabric, and the highest pressure and lowest permeability is achieved by Type LR-1 which embodies a neoprene sheet inner liner with a neoprene-coated Fibreglass fabric outer cover. Type L-9 has the widest temperature range with a pressure range similar to Type L-1 due to a basically similar structure, except for the use of silicone-coated Fibreglass in place of neoprene-coated material.

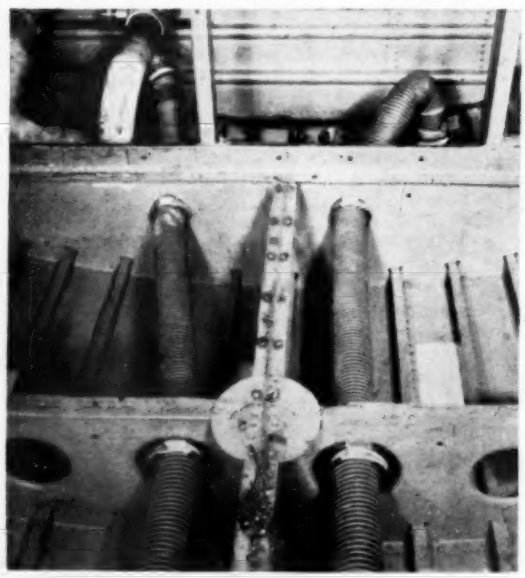
Flexflyte is manufactured on highly polished steel mandrels which serve both as a base on which to assemble the tube and as a support for the tube when it is transferred to the curing oven, after which operation the tube is removed from the mandrel. Mechanical considerations govern maximum mandrel length, and hence the maximum lengths of the tubing which may be produced in each size over the entire range. The end cuffs are built up either at the time of manufacture, or later from stock tube, on the same or similar mandrels. If special end terminations or cuffs with internal diameters either greater or less than that of the tube bore are required, special formers may be required on which the cuff is built up.



Flexflyte is constructed around a helically wound wire which varies in gauge and pitch over the tube size range. The inner and outer covers are normally made of synthetic rubber-coated Fibreglass.

The preferred method of coupling to other components or ducts is for the cuff terminations to be slipped over a tubular portion, with an O.D. equal to the Flexflyte bore. A worm-drive clip is then clamped around the cuff adjacent to the bead, to ensure a snug joint which will not pull off under strain.

Typical applications for Flexflyte cover air distribution to flying surfaces for de-icing purposes; air to windscreen for demisting; heating or cooling air to individual passenger- and crew-louvres or outlets and air to cool electrical equipment.



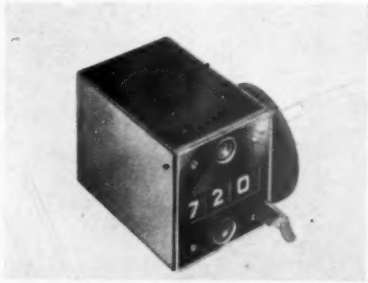
Left, part of a ducting installation in a Bristol Britannia illustrating an application of Flexflyte tubing in aircraft-systems design. Uses for this type of flexible tubing include the protective sleeving for electrical wiring systems and air ducts for equipment cooling.

Electro-magnetic Counters

A NUMBER of new compact light-weight electro-magnetic counters have recently been introduced for use in the aircraft industry by Counting Instruments, Ltd., of Boreham Wood, Hertfordshire. Consisting of a series of moulded number wheels and pinions giving a display from 000 to 999, the counters are being employed as indicators for "gallons gone" and recording special operations.

Each unit is driven from a balanced escapement mechanism which is energized by one or more electro-magnets spaced around a common armature. The mechanical assembly is designed to withstand a high degree of shock and will maintain an accurate count under loads of 7 *g*.

There are a number of variations available from the basic designs and these include presetting subtracting, presetting, and high-speed non-reset units. The presetting subtracting counters can be adjusted to any figure between 1 and 999 and subtract to zero at an operating speed of 20 counts per second. All units operate on 24-V. DC at a maximum rating of 96 m.amp.



Right, one of the three-figure light-weight counters developed by Counting Instruments, Ltd. Working on 24-V. DC supply, the counter has an operating speed of 20 counts per sec.

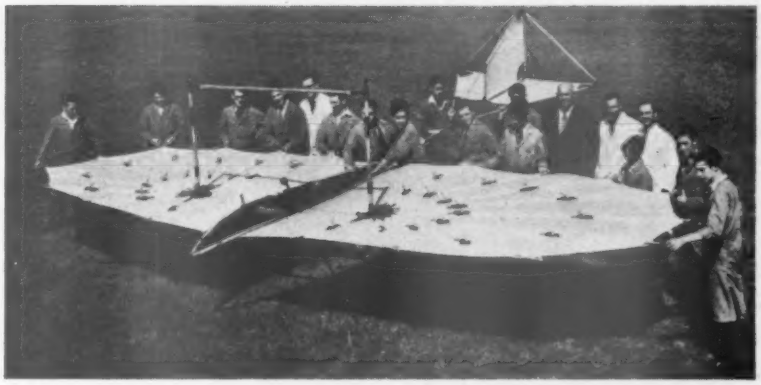
(*Continued from page* 343)

EMPLOYMENT STATISTICS.—Information issued by the Ministry of Labour states that 257,000 were employed in the manufacture and repair of aircraft during December, 1957. This is 7,000 fewer than in December, 1956. Figures for October and November, 1957, have now been amended to 259,000 and 258,400 respectively.

EAGLE APPOINTMENT.—Mr. A. Wagstaff has been appointed district sales and traffic manager for Eagle Airways in Bermuda. He was formerly with the Bermuda Trade Development Board. American staff are being recruited for the company's sales force in the U.S.A., following approval for the operation of a Bermuda-New York service.

TISSANDIER DIPLOMAS

THE F.A.I. has awarded Paul Tissandier Diplomas to *Mr. S. Kenneth Davies* for his work as vice-chairman of the R.Ae.C., 1948-52, as chairman from 1952 to date, as a private aircraft owner, and as chairman of the Welsh Advisory Council for Civil Aviation; to *Mr. Peter G. Masefield* for his contribution to private aviation over a number of years, specially as president of the P.F.A.; to *Mr. D. J. Lyons* for his work as chief R.Ae.C. handicapper for the National Air Races during the past 10 years; and, as we reported last week, to *Mr. F. N. Slingsby* for his contribution to gliding in Great Britain.



PIONEER'S MEMORIAL.—Apprentices of Armstrong Whitworth Aircraft have built a replica of the Hawk glider in which Percy Sinclair Pilcher crashed and was killed on September 12, 1895. The glider is to be presented by the R.Ae.S to Lord Braye at Rugby, on March 26 for the Pilcher Museum. With the apprentices here is Mr. Alan Jenkin, apprentice supervisor.

TOUR OF PERSONNEL. — Air Marshal Sir John Whitley, Air Member for Personnel, was due to leave R.A.F. Bassingbourne on March 10 for a tour of Middle East stations. Piloting a Canberra, he will be making a 11,890-mile tour before returning to the U.K. on March 22.

B.O.A.C. APPOINTMENTS. — Mr. W. J. R. Shepherd has been appointed B.O.A.C.'s assistant sales manager in the U.S.A. Also announced are the appointments of Mr. E. W. Renshaw as senior station officer at Idlewild Airport, New York, and of Mr. A. J. G. Murray as senior flight operations officer, Idlewild. Mr. Shepherd will be succeeded as manager, Chicago, by Mr. R. W. I. Geldard, who was previously manager at Montreal. Going to Montreal as station manager, Dorval Airport, is Mr. R. J. Graham, formerly senior station officer at Idlewild.

ROBERT ROSS.—We regret to record the death (on March 6, 1958) of Mr. Robert Ross, F.A.C.C.A., contracts manager at Handley Page, Ltd., and the vice-chairman (and a past chairman) of the S.B.A.C. contracts advisory committee.

Military Aviation Affairs

FUTURE OF THE R.A.F.—The responsibilities and probable size and shape of the R.A.F. over the next 10 to 12 years will be discussed at a three-day conference which the C.A.S., Marshal of the R.A.F. Sir Dermot Boyle, is to hold for senior officers at the R.A.F. College, Cranwell, betweeen April 16 and 18. This will be followed on May 6 by a one-day meeting and discussion of the most interesting problems which emerge from this conference to some 300 "representative figures from national life."

R.N.-R.C.N. EXERCISES.—The carriers H.M.S. "Bulwark" and H.M.C.S. "Bonaventure" are to take part in joint British-Canadian Naval exercises in the Atlantic. R.C.N. shore-based aircraft from "Shearwater" will fly offensive sorties against the Fleet, and R.A.F. and R.C.A.F. maritime aircraft will co-operate with the sea forces during the anti-submarine phases of the exercises.

RUSSIAN MISSILE CLAIM. — Russian armed forces are equipped with rockets "of short-, intermediate-, long-, and super-long-range operational flight capable of carrying hydrogen charges to any point in the World." This claim was made recently by Marshal Malinovsky, Russian Defence Minister.

GERMAN STARFIGHTERS?—Reports from Washington indicate that Lt.-Gen. Kammhuber, Chief of the West German Air Force, who has just completed a four-week tour of U.S. air bases, will recommend to the Minister of Defence that Germany buys some Lockheed F-104 Starfighters. Lt.-Gen. Kammhuber himself flew the F-104.

GERMAN MISSILES. — The West German Air Force is to receive Martin Matador pilotless bombers from the U.S.A.F.

No. 112 SQUADRON.—The reunion dinner for ex-members of No. 112 Sqn. on May 17, a notice of which appeared in THE AEROPLANE of February 21, is limited to officers and N.C.O. aircrew, and is not an all-ranks occasion as stated.

NAVAL AIR "AT HOME."—The following R.N. Air Stations are to be "At Home" during this year: Ford, June 21; Abbotsinch, June 28; Eglinton, July 19; Culdrose, July 19; Lossiemouth, July 26; Brawdy, August 2; Yeovilton, August 9, and Lee-on-Solent, August 9.

MISSILE CO-OPERATION. — Maj.-Gen. Tyler of the British Army is visiting Australia for talks with officials and to inspect weapon-testing grounds at Woomera and Maralinga; also to discuss repair and maintenance co-operation.

BELGIAN CANUCKS.—Avro Canada CF-100 Mk. 5 all-weather fighters are in service with No. 11 Squadron of the Belgian Air Force's 1st Fighter Wing. The first five of an order for 53 Aircraft arrived at Beauvechain towards the end of last year. CF-100 maintenance crews have been formed at Zweibrücken by instructors from the R.C.A.F. 3rd Wing.

An Early British Designer

WILLIAM OKE MANNING, F.R.Ae.S., one of the very first British aircraft designers, who was born on October 20, 1879, died on March 3. He went to school at London's St. Paul's School and was early attracted, on the design side, to the new science of flying. He began his career in 1909 as a designer in the aeronautical community at Brooklands with Howard Wright who, with his brother Warwick Wright, was a pioneer of motoring. Howard Wright went into partnership with "W.O.M." (as Manning had always been known to his friends) and they produced first the little Avis monoplane and then the Howard Wright biplane. Mr. T. O. M. (now Sir Thomas) Sopwith bought a monoplane to teach himself to fly, but soon crashed it, so he went over to the biplane and qualified for his Aviator's Certificate on it. It was on this first really successful Manning design that Sopwith, at the end of 1910, flew from Eastchurch for 169 miles to Belgium, winning the Baron de Forest prize of £4,000 which provided part of the capital to found the Sopwith Aviation Co. and led on to the Hawker Siddeley Group.

After his association with Howard Wright, "W.O.M." was engaged by the Coventry Ordnance Works and designed the C.O.W. biplane which was entered for the famous Military Trials on Salisbury Plain in 1912.

In the 1914-18 War, "W.O.M." joined the R.N.A.S. but was later released for design work and towards the end of the War he designed flying-boats for the Phœnix Dynamo Manufacturing Co. Both the Coventry Ordnance Works and the Phœnix Dynamo Manufacturing Co., along with three other concerns, eventually merged as the English Electric Co., for whom Manning designed the Kingston and Ayr flying-boats.

For the 1923 Lympne Light Aeroplane Competition, Manning designed the little Wren with a 3½-h.p. motorcycle engine. The type was flown by Walter Longton and Maurice Wright, and won the major prize for the longest distance covered on 1 gal. of petrol.

W. O. Manning wrote many articles for THE AEROPLANE about early flying and the pioneers who have gone, and now he has followed them. But his name will always be remembered as a pioneer designer. He was a member of the executive committee of the Air League and was the author of some technical books and papers.

Lately he had been living near Petworth and on his rare visits to the R.Ae.C. it was a delight to talk to him of the old days.—G.D.

Comet Noise Level

BOLT BARANEK AND NEWMAN, INC., the consulting acoustical engineers, have now completed their report on the noise characteristics of the Comet, following a series of tests at Hatfield last November. The tests were made for the Port of New York Authority, which has now granted permission for the Comet to make demonstration flights under controlled conditions at New York International Airport. The report showed that the noise level of the Comet 4 is slightly below that of typical four-engined piston airliners in service today.

The tests made by Bolt Baranek and Newman engineers covered 13 take-offs and six landings of the Comet 3 G-ANLO, which is, from the acoustics viewpoint, the same as the Comet 4, with similar Avon R.A.29 engines rated at 10,500-lb. s.t. each. Rolls-Royce sound suppressors were fitted. Measurements were taken at four points along a straight line from the runway, at distances of 2.2, 2.5, 3.0 and 3.5 miles from the start of the take-off roll, these positions representing typical residential areas in the vicinity of Idlewild.

The data was assessed in terms of three principal characteristics—noise levels, duration of the noise and frequency distribution of the noise.

In order to give a reasonable range of operating conditions, three pilots flew the Comet on the tests, and in all but two take-offs the technique of climbing at full power to about 1,000 ft. was followed, after which a significant reduction in power was made. This practice gets the aircraft to a good height almost within the airport boundary—say two miles from the start of take-off—and provides the lowest possible noise exposure for the surrounding residential community.

Measurements were also made of a B.O.A.C. DC-7C and a P.A.A. DC-6B which flew to Hatfield specifically for these tests and provided a basis for comparison. The results were also compared with those obtained on the Caravelle operating at Idlewild.

The conclusions of the report, which is an objective study of the measured aircraft noise data based on factors known to influence the average individual and community, are that the noise of the Comet is subjectively comparable with that of large present-day four-engine propeller-driven airliners. In more detail, the report states:—

1. In terms of overall noise levels (the noise readings which cover the entire audible frequency range of 20-10,000 cps.), the DC-7s and Super Constellations produce 8 to 9 db higher take-off noise levels than does the Comet for the measurement positions under the flight path between 2.2 and 3.5 miles from the start of the take-off roll. However, because of relative listener response to noise in terms of its frequency distribution, the noise of a Comet take-off would probably be judged slightly quieter (by possibly 3 to 4 db) than the noise of a DC-7 or Super Constellation take-off when heard out-of-doors. The Comet would be still quieter by comparison when heard inside a typical residence. For the indoor comparison, the Comet and the DC-7 or Super Constellation might be judged to be comparable if the Comet altitudes were approximately halved or if the propeller aircraft altitudes could be doubled over the residential area.
2. The duration of the Comet take-off noise is greater by 10% to 60% than that of the propeller aircraft.
3. The fact that the four-engine Comet is slightly quieter than the two-engine Caravelle is probably due to the fitting of the Comet engines with Rolls-Royce noise suppressors. From observations of the data it appears that the suppressors on the Comet are attenuating the overall noise output approximately 3 to 6 db.

The Comet will be permitted to operate at Idlewild, on its forthcoming demonstration, in daylight hours only and under VFR conditions only. Similar conditions applied to the Caravelle on its visit during 1957. De Havilland have not yet decided when the Comet 3 will visit New York, as it is heavily engaged in flight development.

PRIVATE FLYING

H.J.C.'s Club Commentary:

Sywell Flying

● SATISFACTION at the increase in membership and in flying hours over the past year was expressed by Alderman C. M. Newton, M.B.E., chairman of the **Northamptonshire Aero Club** at the recent annual general meeting. The flying time reached a total of well over 1,000 hr.

Twelve A.T.C. cadets received instruction, and three gained their P.P.L.s; five did not complete training because they were called up, and four are still undergoing instruction.

Seventy club members flew solo during the year, and 65 were trained. Fourteen new P.P.L.s were gained.

● MOST outstanding flying member was adjudged to be Mr. Charles Boddington, and he was accordingly awarded the Championship Cup. He was, incidentally, the winner of the de Havilland Trophy for the Tiger Club aerobatic competition at Sywell last summer.

The club's competitions were won by Mr. A. C. Edmonds (best student pilot); Mr. J. Beaty (two-circuit contest); Mr. K. E. Corbett (navigation contest), and Mr. D. W. N. Carter (general flying).

Continental Air Rallies

● INFORMATION about some of the Continental air rallies to be held this year is announced by the F.A.I.

From May 17 to 19 the fourth international air-touring *rassemblement*, organized by the Quiberon Air Club will be held at Quiberon-Le Roch; and the following week-end (May 24-26), the Royal Aero Club of Belgium is holding a *bienvenue aérienne* at Brussels. Attendance is by invitation only.

In Britain the R.Ae.C. is to hold an international invitation air rally at Shoreham. The date is May 29-June 1. The rally will presumably follow the lines of those excellent occasions of the past when British private flyers entertained some of the Continental air-touring community who provide hospitality when we go abroad.

Next, chronologically, is the Pruvost Grand Prix for helicopters, to be organized by the Aéro-Club de France from June 1 to 3; and the fifth international rally of Basse Normandie is to be held at Flers on June 7-8.

● A TOUR of the Pyrenees is being arranged by the Lerida Aero Club for June 20-23. The Royal Dutch Aero Club has two events on the calendar: an international air rally (June 27-29) and an "air camping" rally (July 12-14).

Two rallies which always prove popular (for a very good reason) are the second rally of the Wines of Alsace, organized by the Aéro-Club Centre Alsace (August 16-17), and the 12th rally of the Wines and Chateaux of Anjou, which is the responsibility of the Aéro-Club de l'Ouest (July 5-6).

The two rallies in which U.K. pilots are naturally very interested, because of the lavish hospitality enjoyed, are the annual occasions when R.Ae.C. members and associate members are respectively the guests of Mme. André and M. François André: the La Baule Rally (June 28-30) and the Deauville Rally (July 5-7).

Finally there is the Innsbruck rally of the Austrian Aero Club which has been arranged for September 26-29.

Perhaps it would be as well at this stage to remind private pilots who intend flying to these rallies that a Customs carnet, issued by the R.Ae.C., is necessary if the rally is not held at a Customs aerodrome.

Coventry's Loss

Photograph copyright "The Aeroplane"

AUSTRALIA BOUND.—Mr. and Mrs. D. J. Hill took off from Southend Airport on March 5 to fly to Australia in a Percival Prentice, G-AONS, named "Koomela." The aircraft has a 7-hr. endurance.

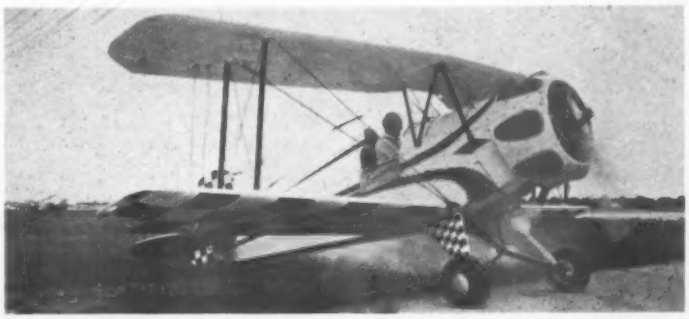
● IN COLLABORATION with the **Shropshire Flying Club** the Department of Extra-Mural Studies of Birmingham University is arranging a course from July 6 to 8 on "Archaeology from the Air," which will involve making observations from the air and taking photographs of ancient sites. There will also be lectures and demonstrations on the origin of crop marks and techniques of flying and photography. Details can be obtained from the University, at Edmund Street, Birmingham, 3.

● WE ARE sorry to hear of the death of Bob Lavell, honorary C.F.I. of the **Coventry Aeroplane Club,** on March 1, at the early age of 40. He flew in the R.A.F. during the War, and later in the R.A.F.V.R., and since joining the Coventry club two years ago had devoted much time and energy in its interests. The honorary secretary of the club, Mr. John Roberts, has said that "Bob did a tremendous amount for the club in the short time he was able to be with us. He made one of the greatest contributions to it of any of the members, and his example was an inspiration to all. He made many friends and will be sadly missed."

Aerobatic Biplane

THIS Bücker Jungmeister, of German origin, is owned by the American aerobatic pilot Bevo Howard, and its red-and-white colour scheme is often seen at air displays. The aircraft was first exported to the U.S.A. just before the War. It was formerly owned by Alex Papana, the Roumanian aerobatic champion, until his death, when it was obtained by Mike Murphy. The original Siemens Halske engine has been replaced by a 220-h.p. Continental.

Levy-Shipp photograph



GLIDING NOTES

AT THE Midland Gliding Club's Easter Rally at the Long Mynd, Church Stretton, at least one of the two new versions of the Olympia 4, which Elliotts of Newbury are preparing for the World Championships in June, is expected to take part, flown by David Ince. This is the 19-m. Olympia 419, intended for the Open Class; the other one, called Olympia 415, designed for the Standard Class with a span restriction of 15 m., may or may not be ready by Easter.

Other entries in the Rally, John Hickling writes, are the club's own two-seat Eagle and an assortment of Skylarks and Olympias from various places.

The number of full-time jobs in gliding continues to increase. The Midland Club is taking on a man to look after its motor transport and winches, and a club member, Jack Minshall, at present on an instructors' course at Lasham, will become a full-time instructor when the courses start.

* * *

SLINGSBY SAILPLANES are also producing two machines for the World Championships, one for each Class—a large and a small Skylark. However, it is not quite certain yet if all four types, one of each Skylark and one of each Olympia 4, will be represented in Poland: what is known is that all our entries will be laminar-flow types, and that they will be flown by Cdr. Nicholas Goodhart, Col. Tony Deane-Drummond, Philip Wills and Cdr. Tony Goodhart.

Entering for the World Championships is, as usual, an expensive business. The Society of British Aircraft Constructors has generously started off the subscription list with a gift of £1,000. Further contributions will be gratefully received by the British Gliding Association at Londonderry House, 19 Park Lane, London, W.1; and there is just time to get a £1 ticket for the Gliding Ball being held at Londonderry House tonight (March 14) in aid of the funds.

An Argentine team is hoping to take part with two machines in each Class, but does not know what they will be. José Ortner has written to ask for the loan of suitable Skylarks, with trailers, but unfortunately Slingsby's are already fully committed to several other teams, so the Argentine team would be grateful for offers of help from Europe.

A national contest, the ninth, was held in Argentina from February 6 to 16 at the Club Argentino de Planeadores "Albatross," near Buenos Aires. José Ortner came out top, flying a Skylark 3, and was followed in order by Alberto Araoz (Skylark 3), A. Sadoux (Sky), R. Hossinger (Sky), H. Bockst (Sky), C. Zurborn (Meise), and R. Bazet (Skylark 2). The weather, Ortner writes to Slingsby, was of Camphill 1934 type, and only five days were flyable.

The Argentine team for the World Championships was decided by this contest, except that Ortner will not be able to come, for the joint reasons of pressure of work and a large family.

* * *

DENMARK is entering four pilots for the World Championships in Poland, Per Weishaupt writes. Joergen Friis and Niels Seyst, who came first and second in last year's National Championships, will be the first Danish Air Force pilots to compete internationally; but they learnt gliding at civilian clubs. Dyhr Thomsen, who represented Denmark two years ago, will do so again, and the fourth pilot, Buch Petersen, is expected to fly a Rhönsegler; the others are likely to fly Olympias, as they are not borrowing any Polish machines.

Last year was the best in Danish gliding history. Total launches—14,378—are down on the 1947 and 1948 figures, but total flying time—2,175 hr. compared with 1,636 in 1956—is the highest ever, and so is the total distance of 6,774 km. (4,209 miles) in 102 cross-country flights, nearly doubling the previous year's distance. Friis became the first to earn a Gold "C" with flights inside Denmark, and 14 completed the Silver "C," while 88 passed the "C" test. There are 529 pilots in Denmark with 69 gliders. The Air Force Clubs do just over half the flying.

* * *

AN alleged altitude record of 29,400 ft. "for a solo powered-aircraft" by S. H. Georgeson in New Zealand, mentioned in a newspaper paragraph a week ago, turns out to have been a gliding record after all; it looks as if some person responsible for transmitting the message was incapable of believing that gliders could do such things and added "power" on his own account. But Philip Wills, who had just left New Zealand when it happened, saw a more truthful report in a Sydney newspaper and has now arrived back in England with the facts.

Georgeson, using wave lift in the lee of the Southern Alps, reached an absolute altitude of 31,200 ft., which is more than 5,000 ft. above his previous best. He started the climb from 1,800 ft., so his gain of height was 29,400 ft. This is 300 ft. better than the World record held by W. S. Ivans, of the United States, but does not exceed his figure by 5%, so cannot be officially recognized. Georgeson was flying solo in the Slingsby Eagle two-seater which recently arrived in New Zealand.

Three years ago, Wills made a height gain of 28,200 ft. and reached 30,400 ft. absolute altitude, flying a Weihe at the same site. On this last visit, when he was there again for the Canterbury Gliding Club's Christmas camp, the atmosphere was less co-operative; he got a launch by aero-tow into the second lee wave, climbed to 20,000 ft. in it, and then pushed upwind to the first wave in the lee of Mount Cook. But between the two waves was a mighty downcurrent in which he dropped 12,000 ft., and he arrived at a turbulent rotor cloud which had formed below and in front of the main lenticular cloud of the first lee wave. Luckily it was nothing like as severe as the rotor of Bishop Wave in California. Worse turbulence had been encountered some time before by Philip's son Christopher in the old Weihe, which was severely holed by hailstones in an N.Z. cu-nim and cracked a tail spar.

At the Sydney Club's Christmas camp in Australia, Wills heard, Mervyn Waghorn made an outstanding long-distance flight and Selwyn Owen failed by only 10 miles to beat the World's record for out-and-return, 311 miles.

* * *

FROM June 12 to 20, at Leszno in Poland, this year's congress of the OSTIV (International Scientific and Technical Organization for Soaring Flight) will be holding its sessions, which will start during the practice period for the World Championships and end halfway through the contest. As usual, the subjects discussed are classified as technical or meteorological, and papers are invited under both heads.

The technical section covers all aspects of sailplane design and auxiliary equipment, as well as the flying, but this time two unusual subjects are included—muscle-powered flight and dynamic soaring—if anyone will talk about them. A project for a muscle-power flying machine has been started at Cranfield, but Terence Nonweiler, who was chiefly responsible, has moved to Belfast. Beverley Shenstone, a couple of years ago, worked out that such a machine should be just practicable, and more so if there were two occupants, one going all out and the other using his legs for power and his arms for steering. August Raspet, of Mississippi State College, calculated that five galley-slaves would be the optimum number.

The Russian flapping-wing machine of five years ago should come under both headings, for its wings were sprung in such a way as to give way to each upgust and then use the stored energy for a downward flap. But are gusts, either vertical or horizontal, as regular as all that? They appear to be so at times in turbulence on the edge of jet streams, and glider pilots have encountered regular short gusts when wave-soaring, at levels where there is a sharp change of wind with height; but they are usually at the rate of several per second, so one's wings would almost have to buzz rather than flap. Mr. T. G. Nyborg is, or was, convinced that there are certain natural periods of gustiness in the atmosphere, and it will be interesting to see if any evidence for this belief comes up at the OSTIV congress.—A. E. SLATER.

AT LASHAM.—Sir Roger Conant, M.P. for Rutland and Stamford, about to take off on his first Olympia flight at Lasham Gliding Centre on February 23.

CORRESPONDENCE

Admiral Phillips and the Use of Aircraft

IN the admirable article by Air Marshal Sir Robert Saundby on "The Disastrous Story of Singapore" (THE AEROPLANE, January 31) there is one statement which in the interests of historical accuracy should not go uncontradicted. Sir Robert says: "Admiral Phillips was one of the staunchest of those naval officers who believed that aircraft were incapable of doing serious harm to capital ships."

On the contrary, in his position as Vice-Chief of Naval Staff, Sir Tom Phillips was only too conscious of the serious harm which had been done in this way, particularly in the Mediterranean in early 1941. In fact, in May of that year he was personally responsible for initiating a meeting with the Air Ministry to consider how fighter protection for the Fleet could be provided or improved. It was agreed at this meeting that the Air Staff should investigate the possibility of meeting the Naval requirements and, in particular, the question of long-range fighter squadrons in the Far East.

R. S. D. ARMOUR
Compton, nr. Chichester. (Captain, R.N., Retd.).

In reply to Capt. Armour's letter we have received the following from Sir Robert Saundby:

I AM sorry if I have done Admiral Phillips an injustice, but there is no doubt that he had a reputation in the Air Force as a staunch believer in the ineffectiveness of aircraft against warships.

Marshals of the R.A.F. Sir Arthur Harris and Sir John Slessor both worked for long periods with Sir Tom Phillips in the Joint Planning Committee, and both greatly admired his many excellent qualities. Sir Arthur Harris, in his book "Bomber Offensive," records that he was very friendly with him and shared the same lodgings in Ebury Street. He says that Admiral Phillips "would never bring himself to admit that air power could have any serious effect on naval operations." He adds: "He could have had some fighter cover, though there would not have been much of it and it would probably have been ineffective. . . . But he would not break wireless silence to ask for fighter protection when he saw a Japanese aircraft shadowing the 'Prince of Wales' the evening before. Well he knew that he was looking for trouble with only two ships against the Japanese fleet, but he did not regard the air as dangerous." (Pages 274-5.)

Sir John Slessor, in his book "The Central Blue" says: "Tom Phillips was a splendid Naval officer and a staff officer of exceptional calibre. It was perhaps the one defect of his outstanding qualities that he was quite irrational on the subject of air power in relation to navies." He adds: "Tom resolutely and sometimes violently rejected the idea that an aeroplane could be any real threat to a man-of-war." (Page 277.)

My own acquaintance with Admiral Phillips, though it was not so intimate or extensive, certainly led me to agree with these views.

Burghclere, near Newbury. R. SAUNDBY.

Terpsichorean Terminology

A NICE point has been raised by Mr. Parkhouse in his question—reported by Wren in the current (February 28) issue of THE AEROPLANE. Why, indeed, was the recent R.A.F. transport exercise code-named "Operation Quickstep"? Correctly, Mr. Parkhouse suggests that the two Beverleys, two Comets and one Beverley used can be taken to represent the familiar Terpsichorean tempo "slow-slow-quick-quick-slow." But surely this is also a slow foxtrot? Quite clearly the Air Ministry planners cannot be counted among those who "can't tell a waltz from a tango."

London, W.1. "PASEUL."

Age and Experience

ONE HEARS of various schemes to train pilots for commercial aviation to overcome a chronic shortage, schemes which generally mean that the pilot is trained to the minimum standard to obtain the Commercial Licence.

These pilots would then presumably be flying as co-pilots on passenger-carrying aircraft.

In my experience of sounding the commercial aviation field I find that neither B.E.A. nor B.O.A.C. will accept a pilot over 30 years of age, regardless of experience in the Royal Air Force.

At 33 with 3,000 hr., mostly twins and four motors, an A.2 Instructor category, and spotless flying record, I am told that I am too old for the Corporations, yet B.E.A. and B.O.A.C. captains are practically all over 30.

B.E.A. have actually accepted as pilots men who were scrubbed from Service flying training in the basic stage, because they were unsuitable.

This leads one to ponder upon the eventual standard of flying in the State airlines.

One would have considered that in the airlines flying hours and experience would be at a premium when considering applicants, but instead one finds the accent on youth—regardless of hours—or multi-engine experience.

This letter is not a tirade against youth which has worked miracles in the air for Britain, but with a passenger load experience is needed on the bridge.

Newquay. "EXCALIBUR."

Groundabout

The Inner Man—1. News of a couple of lively types. Harold Best-Devereux, who recently left Edgar Percival's company, has just made a consultative trip to the steaming Congo, where he met Ladislav Marmol, Czech ex-glider aerobattist and Proctor racer, who is crop-spraying out there with his E.P.9. Ladi's adventures would fill a book (the last time I wrote here about him he was flying a Neon-stuffed advertising Aerovan over German cities at night). In Africa, he told "Dev," he once landed on a remote strip and had to spend the night in the local convent where due to some fast there was no food. After going to bed hungry he was awakened at 4 a.m. by the prayer-bell tolling and stayed hungry until the next landing.

*

The Inner Man—2. "Dev," held up in Paris by fog on the way back, was poised ready and hungry for an Epicurean Air France lunch. He was deeply shaken when a charming French voice invited London passengers to adjourn to the lounge where they would be served with an "appetite." Since "Dev" always takes his appetite along, anyway, he was relieved when it turned out to be an apéritif, followed by an excellent *déjeuner*.

*

My Next Trick is Impossible. Looking through an airfield clubhouse window recently, I saw a remarkable sight. A Tiger Moth landed, taxied to a stand near the control tower and four adults got out of it. It was, of course, the delightfully named Thruxton Jackaroo and the pilot, Jim Doran-Webb, who

"fathered" the project, described it in simple words for my benefit: "Tiger split down middle, widened, cheap 4-seater with detachable canopy for crop-duster conversion—A.R.B. very helpful, C. of A. in 18 months from first design. Orders? Coming in nicely, especially from overseas. Production? Two a month but accelerating."

*

Rock 'n Rolls. Somehow I have never associated Rolls-Royce with "wow!" but here it is in their staff journal, *Rolls-Royce News*: "Enthusiasm runs high in Britain when big cup-ties are played but wow! how about this one from Canada?" Certainly "this one" is wow-worthy, telling of the arrival by Viscount at Winnipeg Airport of the victorious Blue Bombers football team. They were met almost on the runway by 12,000 wildly enthusiastic fans who beat up the aircraft but the four Darts "came through O.K." Dig me, Derby, dig me.

by Gnome

NOTES AND EVENTS

GOOD SAMARITAN.—During the recent bad weather the A.A.'s D.H. Rapide (see this page) made a survey of road conditions in Scotland. The crew of the aircraft, Mr. D. H. Whitehead (middle) and Mr. W. Lewis, (right), are here seen receiving emergency food packs which were flown to Aberdeen.

MATERIALS INFORMATION.—A new service to industry consisting of the collation of data on all materials, and the comparison of these on the basis of their design characteristics, has been started by Materials Data, Ltd., of 273 Farnborough Road, Farnborough, Hants. A private company being developed on a normal commercial basis, this materials information centre dealing with steels, alloys, woods, plastics, electrical materials, refractories and adhesives, is open, through membership, to any company, manufacturer or individual.

PRIVATE HELIPORT.—Dunlop and Ranken, Ltd., constructional engineers and steel stockholders, plan to build a helicopter landing site at the engineering works at Farnley, Leeds. The firm intends to operate to and from Yeadon Airport, probably using two aircraft.

APPRENTICE TRAINING.—At the Swindon works of the Plessey Co., Ltd., a bay of one of the factories has been equipped as an apprentice training school. Sixty-eight apprentices are now employed in the Swindon group of factories and this figure is expected to rise to about 90 in the summer.

PRODUCTION EXHIBITION.—The theme of this year's Production Exhibition and Conference at Olympia between May 12 and 21 is "Production Fights Inflation." Organized by the Institution of Production Engineers, the exhibition is the third in the series and will include sections on research and development.

INDUSTRIAL FELLOWSHIPS.—The Wilmot Breeden Group of Companies, whose manufacturing interests include motor vehicle and gas-turbine components, hydraulics and electronics, is sponsoring two Fellowships, each worth £1,000 per annum, one at the University of Birmingham and the other at the College of Technology. Details of the Fellowships can be obtained from the secretary, Wilmot Breeden (Holdings), Ltd., Amington Road, Birmingham, 25.

AIRCRAFT PHOTOGRAPHS.—The Real Photographs Co., Ltd., informs us that it now has a stock of some 5,000 aircraft picture titles. These are contained in four lists (covering British warplanes—Monoplanes; British Warplanes—Biplanes and Floatplanes, etc.; Warplanes of the 1914-18 War, and American Warplanes) obtainable from the company at Victoria House, Southport, Lancs, price 6d. each.

AIRBORNE PATROL.—The Automobile Association has bought a D.H. Rapide for the patrol and traffic-spotting duties hitherto done by its Auster Alpine. Among the flying aids carried in the Rapide are a radio compass and SBA, as well as two VHF radios for communication with road patrols and headquarters. Since August, 1956, the Alpine has flown about 250 hr. on 130 sorties.

WELSH FACTORY.—A new factory is to be built at Treforest, Glam, to house Firth Cleveland Instruments, Ltd., which was formed in May, 1957, as a subsidiary of Simmonds Aerocessories, Ltd.

RUBBER DIRECTORY.—The 1958 edition of the "Directory of British Rubber Manufacturers and Products" has just been published by the Federation of British Rubber and Allied Manufacturers. The 204 pages provide a complete buyers' guide to the British rubber industry in French, German and Spanish besides English. It can be obtained from the Federation offices, 43 Bedford Square, London, W.C.1 (25s., plus 3s. for packing and postage, in Britain, free to overseas rubber importers).

Aviation Calendar

March 17.—R.Ae.S. Bristol Branch, Barnwell Memorial Lecture, "The Economy of Structures," by Sir Alfred Pugsley, in the conference room, Bristol Aircraft, Ltd., Filton House, **Bristol,** at 18.00 hrs.

March 19.—R.Ae.S. Leicester Branch lecture, "Aircraft Photography, 1913-57," by John Yoxall, in the lecture theatre, **Loughborough College,** at 18.45 hrs.

March 20.—R.Ae.S. section lecture, "Problems in the Development of a Guided Missile," by J. Clemow, M.A., at the Royal Institution, 21 Albemarle St., **London,** W.1, at 18.00 hrs.

March 21.—Inst. of Navigation lecture, "The Effective Utilization of Air Space," by E. J. Dickie, M.B.E., at the R.G.S., 1 Kensington Gore, **London,** S.W.7, at 17.15 hrs.

March 25.—R.Ae.S. Luton Branch A.G.M. and Presidential Address, in the Napier senior staff canteen, **Luton Airport,** at 18.15 hrs.

March 26.—R.Ae.S. Preston Branch lecture, "American Production Methods," by A. W. Turner (D.H., Broughton), in the Queen's Hotel, **Lytham,** Lancs, at 19.30 hrs.

March 27.—13th British Commonwealth lecture, "Why Airlines are Hard to Please," by B. S. Shenstone, F.R.Ae.S., at the Inst. of Civil Engineers, Gt. George St., **London,** S.W.1, at 18.00 hrs.

March 27.—R.Ae.S. Bristol Branch A.G.M. and film show, in the conference room, Bristol Aircraft, Ltd., Filton House, **Bristol,** at 18.00 hrs.

April 1.—R.Ae.S. Luton Branch lecture, "Arctic and Tropical Trials," by R. K. Cushing, O.B.E., A.F.R.Ae.S., in the Napier senior staff canteen, **Luton Airport,** at 18.15 hrs.

April 1.—R.Ae.S. Boscombe Down Branch lecture, "Aircraft Accident Investigation," by E. L. Ripley, O.B.E., B.Sc., D.I.C., A.F.R.Ae.S., in the lecture hall, A. and A.E.E., **Boscombe Down,** Hants, at 17.45 hrs.

Company Notices

NEW COMPANIES

Aviation Training, Ltd. (599,026).—Private co. Reg. Feb. 18. Cap. £1,000 in £1 shs. Objects: To carry on an aviation school, etc. Directors: Ronald J. Clark and Mrs. Simone B. Clark, both of 8 Greville Rd., Richmond, Surrey. Sec.: Simone B. Clark. Reg. off.: 16 New Broadway, London, W.5.

Trident Scandia Lines, Ltd. (599,084).—Private co. Reg. Feb. 18. Cap. £1,000 in £1 shs. Objects: To establish, maintain and operate shipping, air and road transport services, etc. Directors: George W. Staddon, "Carradale," Temple Close, Watford; William F. Death, 21 Park Avenue, Ruislip; John B. Miller, "Hilbry," Oakway, Reigate (all directors of John Miller (Shipping), Ltd.). Sec.: G. W. Staddon. Solrs.: Harold Benjamin and Collins, 9 Drapers Gardens, London, E.C.2. Reg. off.: Port of London Building, London, E.C.3.

OVERSEAS COMPANY

Jersey Airlines (Channel Islands), Ltd. (F.4,677).—Particulars filed Feb. 18, 1958, pursuant to section 407 of the Companies Act, 1948. Cap. £1,000 in £1 shs. Reg. in Jersey, Channel Islands, on Jan. 4, 1958, to act as agents for Airlines (Jersey), Ltd., etc. British address: 80 New Bond St., London, W.1, where John E. Talbot is authorized to accept service of notices and process. Directors: Maldwyn L. Thomas; Bernard W. Gardiner; Thomas C. Chandler, all resident in Jersey.

New Patents

APPLICATIONS ACCEPTED

793,927.—Fairey Aviation Co., Ltd.—"Rocket containers for aircraft."—Aug. 12, 1953 (May 15, 1952).

793,949.—T.K.S. (Aircraft De-icing), Ltd.—"Means for distributing fluids."—Nov. 9, 1955 (Nov. 12, 1954).

793,928.—Rolls-Royce, Ltd.—"Methods and means of operating aircraft."—Sept. 3, 1953 (June 4, 1952).

793,823.—Power Jets (Research and Development), Ltd.—"Helicopters."—Oct. 30, 1956 (Nov. 12, 1954).

793,782.—Fairey Aviation Co., Ltd.—"Auxiliary transmission gears."—Sept. 21, 1955 (Sept. 29, 1954).

793,986.—Caillette, G.—"Turbo-jet units."—Jan. 19, 1956 (Jan. 25, 1955, and Jan. 25, 1955).

Applications open to public inspection on April 23, 1958; opposition period expires on July 23, 1958.

Personal Notices

BIRTHS

Bevan.—On February 26, at Harrogate, to Kathleen, wife of Sqn. Ldr. R. C. S. Bevan, R.A.F.—a son.

Bliss.—On February 25, at B.M.H., Rintein, B.F.P.O., to Shirley (*née* Chapman), wife of Sqn. Ldr. E. Bliss—a daughter.

Braid.—On February 26, at Redruth, to Betty, wife of Sqn. Ldr. G. Braid—a daughter.

Durley.—On February 18, to Thelma (*née* Perrin), wife of S. Durley, of R.A.F. Goch, B.F.P.O. 43—a son.

Getgood.—On February 27, at Reading, to Judith (*née* Snart), wife of Flt. Lt. L. V. Getgood, R.A.F.—a son.

Greenhalgh.—On February 26, at Marfield Nursing Home, to Sylvia (*née* Flint), wife of the late Flt. Lt. R. Greenhalgh—a daughter.

Hanna.—On February 17, at Hillingdon Hospital, to Peg (*née* Phillips), wife of Sqn. Ldr. G. Hanna—a son.

Moore.—On February 25, at Aldershot, to Eileen (*née* Hudson), wife of Sqn. Ldr. B. Moore—a daughter.

Peirse.—On March 3, at Cranwell, to Karalie, wife of Flt. Lt. R. C. F. Peirse—a daughter.

Pickard.—On March 2, at Oakham Maternity Hospital, to Pamela, wife of Flt. Lt. C. F. Pickard—a daughter.

Scarrott.—On March 1, to Yvonne, wife of Flt. Lt. H. A. Scarrott—a daughter.

Sewell.—On February 24, at R.A.F. Hospital, Nocton Hall, to Yvonne (*née* McFarland), wife of Flt. Lt. J. E. Sewell—a daughter.

Shields.—On February 22, at the R.A.F. Hospital, Halton, to Diana (*née* Field), wife of Flt. Lt. R. Shields—a son.

Sugden.—On March 2, in Cyprus, to Freda (*née* Bades), wife of Sqn. Ldr. P. Sugden—a son.

Tottman.—On February 27, at Merthyr Guest Hospital, Templecombe, to Angela (*née* Rogerson), wife of Flg. Off. S. Tottman—a daughter.

Williams.—On January 14, at R.A.F. Hospital, Nocton Hall, to Valerie, wife of Flt. Lt. J. M. Williams—a daughter.